

DIATOMS,
COLLECTED
DURING
THE EXPEDITION OF THE VEGA

EXAMINED
BY
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(COMMUNICATED 1883, MARCH 27.)

WITH FOUR PLATES.

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During the expedition of the Vega Mr. Kjellman collected a number of samples containing diatoms, which with the permission of Prof. Nordenskiöld were delivered to me for examination.

The gatherings were the following:

1. Five bottles with diatoms collected on the ice near Cape Wankarema.

2. Diatoms washed from algæ, collected near Pitlekaj, Cape Deschnew (East Cape).

3. Surface diatoms from the Behring Sea.

4. Fresh-water diatoms from Japan.

5. Diatoms from algæ collected on the Island of Labuan near Borneo.

6. Diatoms washed from algæ collected near Point de Galle, Ceylon, and coarse bottom-mud, dredged in the same locality.

7. Mud from the bottom between Aden and Bab-el-Mandeb.

Besides there were taken several samples of mud from the bottom of the North Siberian sea, which all proved free from diatoms.

For the examination of several of these samples, sufficiently clean slides could not be prepared by the usual cleaning process, so that the specimens must be selected and mounted. In this difficult work I had the good fortune to be helped by the german microscopist Mr. Weissflog, who prepared for me, with the most exquisite skill, slides containing diatoms from Labuan, Ceylon and Bab-el-Mandeb. For this considerable assistance, without which I should hardly have found so many species, I render him my best thanks.

I. Diatoms of the Arctic Sea.

The first notices about the diatoms of the Arctic Sea have been given in 1841 by Ehrenberg, who examined some

samples from Spitsbergen and later, in 1853, some from Assistance Bay ($73^{\circ}50'$ N. lat.)¹. The limited number of arctic species found by Ehrenberg was considerably increased by O'Meara², who published, in 1860, a list of diatoms, gathered during the arctic expedition of the »Fox» under the command of Sir Leop. M'Clintock. O'Meara enumerates not less than 85 species, among which several are fresh-water inhabitants and some doubtful, the limits of the species being at that time in many cases others than admitted at present.

The Swedish expedition to Spitsbergen, in 1861, under the direction of Torell, procured some material containing marine diatoms, which were examined by myself³. Later I obtained better materials, especially many very rich and interesting gatherings from the surface of the northern Atlantic and Davis Strait, collected during the Swedish expedition under Norden-skiöld to Greenland in 1870. The result of the examination of these materials, as well as many others from Spitsbergen, obtained from the Riksmuseum of Stockholm, was published in 1873⁴. Afterwards Mr. O'Meara published a catalogue of species⁵ collected by Mr. Eaton on the voyage of Mr. Leigh-Smith. Mr. O'Meara found several new species, which, however, have been figured in such a manner, that the identification may be impossible without original specimens for comparison.

During the Swedish expedition in 1875 and 1876 to the Kara Sea and to Yenisei M. M. Kjellman, Lundström and Stuxberg collected several samples containing diatoms, which were of the greatest interest for the knowledge of the diatoms in the Arctic Sea, east of Spitsbergen. Also has Mr. Kjellman, during his exploration of the algæ of the coasts of Finmarken, collected most rich and interesting materials, containing diatoms from the northern part of Norway. All these materials were examined by Mr. Grunow and myself⁶. During the expedition of the Vega Mr. Kjellman collected extremely rich and important materials on the ice-flakes near Cape Wankarema. The species contained in these samples were numerous and in a most astonishing or almost incredible a manner variable, so that it was in many cases scarcely possible

¹ Monatsber. der Berl. Akad. 1841, page 206 and 1853, page 522.

² Journ. Roy. Dublin Soc. 1860 July.

³ Öfvers. K. Sv. Vet. Akad. Förh. 1867, page 661.

⁴ Bihang till K. Sv. Vet. Akad. Handlingar, Vol. I, N:o 13.

⁵ Micr. Journ., Vol. XIV (NS) pag. 253.

⁶ K. Sv. Vet. Akad. Handl. Vol. XVII, N:o 2, 1880.

to trace out the limits of the species. Also were rich, but less interesting materials obtained from algæ, collected near Cape Deschnew. Several samples of the bottom-mud from the North Siberian Sea were also taken, but in examining them I could not find a trace of diatoms. All the materials from the expedition of the Vega have been examined by myself. Still more materials from the hyperboreal America were collected during the British expedition under the command of Sir George Nares and examined by Mr. G. Dickie¹. Afterwards I have received, through the kindness of Prof. Oliver, some of these samples. Among them only three were rich enough to be subjected to the usual cleaning-process, viz. from *Bessel's Bay*, 81° 7' N, *Mushroom Point*, 82° 28' N, and *Discovery Bay*, 81° 41'.

The result of my examination of these gatherings are to be found in the following pages. Also from the distant Franz Joseph Land some diatomaceous gatherings have been collected on the ice-flakes during the Austrian expedition under Weyprecht. Some of the species found by Mr. Grunow in these materials have been published in Van Heurck's Synopsis and issued in Cl. and Möller Diat. No 314. Mr. Grunow will later publish in a more complete manner his researches in regard to these most interesting diatoms. The materials brought together from the Arctic Sea are thus very considerable, and their examination may give a tolerably complete idea of the diatomaceous vegetation the Arctic Sea. I have therefore tried to give in the following pages a complete list of all the arctic species, found by myself and by Mr. Grunow, omitting those found by other authors, not being sure about their determinations.

Index of marine arctic Diatoms.

A. Placochromaticæ.

I. Cocconeidæ.

Cocconeis Scutellum Ehb. (Van Heurck Syn. XXIX, 1—12) Greenl., Mushroom Point, Fr. J. L.², Spitsb., Finm., Kara, Cape Deschnew (East Cape).

¹ Jour. Linn. Soc. Vol. XVII, page 6.

² F. J. L. Franz Joseph Land according to Grunow.

var. *stauroneiformis*, Spitsb., Finm., Mushr. P., Cape Deschnew (East Cape).

forma *parva*, — Cape Deschnew (East Cape).

f. *minutissima* Grun. — F. J. L.

C. distans Greg. (D. of Cl. Pl. IX, fig. 23, A. Schm. N. Sea Diat. III, fig. 22—23) Mushroom Point, Kara.

C. pseudomarginata Greg. (D. of Cl. Pl. IX, fig. 27, *C. pellucida* Grun. Verh 1863 Clev. D. of the A. S. pag. 14) Greenl., Spitsb., Finm., Kara.

C. dirupta Greg. (Van Heurck Syn. Pl. XXIX, fig. 13—14) Greenl.

C. decipiens Cl. (D. of the A. S. pag. 14, Pl. I, fig. 6, lower valve, Pl. II, fig. 11 *a*, upper valve) striæ on the upper valve 19 in 0,01 mm. — Greenl., Bessel's Bay, Finm.

C. arctica Cl. (D. of the A. S. pag. 14, Pl. II, fig. 11 *b*, upper valve). Length 0,03 mm. Br. 0,018 mm. Lower valve with sigmoid median line and coarse striæ, composed of distinct puncta, 12 in 0,01 mm. Central nodule, surrounded by a small area. Upper valve without distinct median line and central nodule. Striæ interrupted, marginal and axial 11 in 0,01 mm.

Pl. 35, fig. 4 *a*, lower, *b*, upper valve.

Greenl., Bessel's Bay, Finm.

C. costata Greg. (Van Heurck Syn. Pl. XXX, fig. 11—12) Greenl., Mushroom Point, Spitsb., Finm.

C. finmarchica Grun. (Arct. Diat. p. 16 Pl. I, fig. 1) Bessel's Bay, Finm.

C. quarnerensis (Grun.) A. Schm. (N. Sea Diat. Pl. III, fig. 15—16) Greenl., Spitsb., Finm.

2. Mastogloiaceæ.

Mastogloia ovata Grun. (A. Diat. Pl. I, fig. 2) Finm., Kara.

M. kariana Grun. (A. Diat. pag. 17, Pl. I, fig. 3) Kara.

3. Achnantheæ.

Achnanthes subsessilis Kütz. (*Achnanthidium arcticum* Cl. D. of the A. S. p. 25, Pl. IV, fig. 22, *A. brevipes* Ag.) Greenl., Mushroom Point, Spitsb., Finm.

A. coarctata (Bréb) Grun. Mushroom Point.

A. grönlantica (Cl.) Grun. (*Achnanthid.* Cl. D. of the Arct. Sea, pag. 25, Pl. IV, fig. 23) Greenl., Bessel's Bay (common), Spitsb., Finmark.

The fig. previously published by myself is taken from balsam-mounted specimens and not sufficiently exact, for which reason I have drawn a new sketch of the upper and lower valves Pl. 35, fig. 3 *a*, lower valve, *b*, upper valve.

A. (hungarica Grun. var.?) *jamalinensis* Grun. (A. Diat. pag. 20, Pl. I, fig. 4) Kara.

A. (?) tæniata Grun. (Arct. Diat. p. 22, Pl. I, fig. 5) Kara.
var.? *hyperborea* Grun. F. J. L.

A. delicatula (Kg.) Grun. (Van Heurck Syn. Pl. XXVII, fig. 3—4) Greenl., Bessel's Bay.

4. Amphoreæ.

Amphora lævis Greg. (Grun. Arct. Diat. pag. 24, Pl. I, fig. 8) Kara.

A. lævissima Greg. (D. of Cl. pag. 513, Pl. XII, fig. 72) Kara, Finm.

A. ostrearia Bréb. (A. Schm. Atl. Pl. XXVI, fig. 23) Finm.
var. *nova caledonica* Grun.? (A. Schm. Atl. Pl. XXVI, fig. 24) Davis Strait.

var. *vitrea* Cl. (Öfvers. af K. Sv. V. Ak. Förh. 1868, pag. 237, Pl. IV, fig. 5—6) Spitsb. — Length 0,085 mm. Br. 0,068 mm. Striæ, composed of distinct puncta, 9 in 0,01 mm., on the connect. membrane 11 in 0,01 mm.

A. ocellata Donk. var. *jamalinensis* Cl. & Grun. (A. Diat. pag. 24, Pl. I, fig. 6) Kara.

A. Weissflogii A. Schm. (Atl. Pl. 25, fig. 59) Davis Strait. Length 0,06 mm. Striæ costate, 10 in 0,01 mm.

A. acuta Greg. (D. of Clyde, pag. 524, Pl. XIV, fig. 93 and 93 b.) Greenl., Spitsb., Finm.

A. hyalina Kütz. (A. Schm. Atl. Pl. XXVI, fig. 52—55) Spitsb.

A. lineolata Ehb. Kara (sec. Grun.) Small form with 20—21 striæ in 0,01 mm.

A. lineata Greg. (A. Schm. Atl. Pl. XXVI, fig. 59, *A. granulata* Greg.?) Greenl., Bessel's Bay, Spitsb., Finm., Kara.

A. tenera W. Sm. (Syn. I, pag. 20, Pl. XXX, fig. 252)? Finm.

A. coffeæformis Kütz. (A. S. Atl. Pl. XXVI, fig. 56—58) Kara.

A. lanceolata Cl. (Öfvers. K. Sv. Vet. Ak. Förh. 1867, pag. 667, Pl. XXIII, fig. 2) Greenl., Finm., Spitsb., Kara.

Valve acute, median line straight, striæ costate, parallel in the exterior, more or less radiant in the interior part of the valve not reaching the median line. Striæ in typical speci-

mens 8 in 0,01 mm., but vary more dense. In a small specimen var. *minor* Cl. from Pitlekaj Cape Deschnew (East Cape) I counted 14 striæ in 0,01 mm.

A. angusta Greg. var. *arctica* Grun. (A. Diat. pag. 24, Pl. I, fig. 29) Spitsb., Kara.

A. Proteus Greg. (Diat. of Cl. pag. 518, Pl. XIII, fig. 81) Greenl., Bessel's Bay, Mushroom Point, Spitsb., Finm., Kara.

var. *kariana* Grun. (A. Diat. pag. 24, Pl. I, fig. 7) Kara, Cape Deschnew (East Cape), Greenland.

A. robusta Greg. (D. of Cl. pag. 516, Pl. XIII, fig. 79) Spitsb.

var.? *A. Schm.* Atl. Pl. XXVII, fig. 44 — Greenl., Spitsb., Cape Deschnew (East Cape).

A. Erebi Ehb. (*A. cymbifera* Greg. Diat. of Cl. pag. 526, Pl. XIV, fig. 97, *A. Schm.* Atl. Pl. XXV, fig. 17, 18, 19, 33, 36, Pl. XXVI, fig. 33, *A. Leighsmithiana* O'M.?) Striæ costate. — Greenl. Mushroom Point, Spitsb., Finm., Kara, Cape Deschnew (East Cape).

A. cymbifera (Greg.?) Cl. (*A. Schm.* Atl. Pl. XXV, fig. 35) Striæ composed of distinct puncta. — Greenl., Spitsb.

One specimen from Greenl. measures in length 0,12 mm. and has 7 striæ in 0,01 mm.

A. spectabilis (Greg.?) *A. Schm.* (Atl. Pl. XL, fig. 20—23.

A. furcata Leuduger Fortmorel) Davis Strait.

A. Grevilleana Greg. Finm.

A. fasciata Greg. (Tr. M. S. V. Pl. I, fig. 36, D. of Cl. Pl. XIII, fig. 91) Finm.

A. complexa Greg. (D. of Cl. fig. 90) Spitsb., Brandewijne Bay. — Striæ composed of distinct puncta $12\frac{1}{2}$ in 0,01 mm. on the valve, 17 in 0,01 mm. on the connecting membrane.

A. Arcus Greg. (T. M. Soc. V. pag. 75, Pl. I, fig. 37) Spitsbergen, Hinlopen Strait.

A. Eunotia Cl. (D. of the A. S. pag. 21, Pl. III, fig. 17) Greenl., Finm., Spitsb., Kara.

Specimens from Spitsbergen have $7\frac{1}{2}$ striæ in 0,01 mm. on the valve and 11 in the connecting membrane.

A. crassa Greg. (D. of Cl. pag. 524, Pl. XIV, fig. 94) Greenl., Spitsb., Finm., Kara, Cape Deschnew (East Cape).

A. subinflata Grun. (*A. S.* Atl. Pl. XXVI, fig. 49) Finm.

A. plicata Greg. (T. M. S. V. pag. 70, Pl. I, fig. 31) Spitsb.

A. (baltica Grun. var.?) *arctica* Grun. (Cl. & M. Diat. No 172) Davis Strait. Not known to me.

5. Gomphonemeæ.

Rhoicosphenia curvata (Kütz) Grun. (*Gomphonema curvata* and *G. marina* W. Sm. Syn. 1, Pl. XXIX, fig. 245—246) Greenl., Bessel's Bay, Spitsb., Finm., Cape Deschnew (East Cape).

Gomphonema kamtschaticum Grun. (Casp. S. Alg. pag. 12, Pl. III, fig. 4. Van Heurck Syn. Pl. XXV, fig. 29) Greenl., Bessel's Bay (a small form, length 0,03 mm. br. 0,005 mm. Striæ 15 in 0,01 mm. in the middle 18 in the end.) Mushroom Point. Cape Wankarema (var. *siberica* Grun. in Cl. M. Diat. 315—318, more slender and linear; striæ less radiant.)

G. pachycladum Bréb. (Van Heurck Syn. Pl. XXV, fig. 31—32) Cape Wankarema. Striæ parallel, 16 in 0,01 mm. Length 0,027 mm. Br. 0,006 mm.

G. arcticum Grun. (Van Heurck Syn. Pl. XXV, fig. 30) F. J. L., Novaya Zemlya (on the ice), Cape Wankarema.

6. Naviculaceæ.

Navicula Bory.

Sectio: *Pinnularia*.

Navicula Pinnularia Cl. (Öfvers. af K. Sv. Vet. Ak. Förh. 1868, pag. 224, Pl. IV, fig. 1—2. *N. quadratarea* A. S. N. Sea Diat. Pl. II, fig. 26) Greenl., Mushroom Point, Spitsb., Finm., Kara, Cape Wankarema.

In the Cape Wankarema material occur a number of varieties. The valve varies from subconstricted to gibbous in the middle with all possible transitions to *N. Stuxbergii* Cl. The striæ are in some specimens from the same locality interrupted and vary from 9 to 12 in 0,01 mm. var. *interrupta* Cl. Pl. 36, fig. 21.

Another variety, *asymmetrica* Cl., has the striæ on one half of the valve more approximate to the median line, than on the other. Length 0,08. Br. 0,018, striæ 8 in 0,01 mm. obscurely punctate.

N. Stuxbergii Cl. (A. Diat. pag. 13, Pl. I, fig. 15) F. J. L., Kara, Cape Wankarema.

var. *subcontinua* Grun. F. J. L. (unknown to me).

var. *leptostauron* Grun. F. J. L. (unknown to me).

N. fluminensis Grun. (Verh. 1860 pag. 520, Pl. I, fig. 7) Kara.

var. *minor* Grun. (A. Diat. pag. 28, Pl. I, fig. 12) Finm.

N. cruciformis Donk. (Brit. Diat. Pl. X, fig. 4) Finm.

var. *brevior* Cl. — Length 0,035 mm. Br. 0,009 mm. Str. 14 in 0,01 mm. Cape Deschnew (East Cape). — Pl. 35, fig. 18.

* *Théelii* Cl. (A. Diat. pag. 13, Pl. I, fig. 22) Kara, Cape Deschnew (East Cape). Specimens from Cape Deschnew (East Cape) have the length 0,05 mm. and the br. 0,018 mm. Striæ 12 in 0,01 mm. In the Cape Deschnew (East Cape) material occur some specimens, which seem to connect *N. Théelii* with *N. Pinnularia*.

N. decurrens (Ehb.) Grun. In the Cape Deschnew (East Cape) gathering occurs a *Navicula*, which Grunow refers to *N. decurrens*. It has about 11 costate and radiant striæ in 0,01 mm., which do not reach the median line. Length 0,06 mm. Breadth 0,013 mm. The valve is linear with gibbous middle and rounded obtuse ends. Median line is slightly undulating. In some specimens the striæ are absent in the middle of the valve, in which case the form seems to be closely allied with *Nav. cruciformis* although the latter has the striæ reaching to the median line. On the other side it seems also akin to *Nav. bica-pitata* Ldt. — Pl. 36, fig. 20.

N. globiceps var. *crassior* Grun. (A. Diat. pag. 27, Pl. I, fig. 13) Kara (fresh-water species?).

N. megastauros Cl. — Small, elliptic, probably depressed in the middle. Striæ costate, oblique, reaching the median line, except in the middle, where they are very short or marginal, so that the central nodule is surrounded by a large stauros. Striæ 16 in 0,01 mm. Length 0,02 mm. Breadth 0,008 mm. Cape Deschnew (East Cape). — Pl. 36, fig. 19.

Sectio: Limosæ.

N. ventricosa (Ehb.?) Donk var. *subundulata* Grun. (A. Diat. pag. 29, Pl. I, fig. 16) Kara.

var. *Kjellmaniana* Cl. (A. Diat. pag. 29, Pl. I, fig. 17) Finm.

N. subventricosa Grun. (A. Diat. pag. 29, Pl. I, fig. 19) Kara.

N. liber W. Sm. (A. S. Atl. Pl. L, fig. 16—18) Greenl., Spitsb., Finm.

var. *elongata* Grun. (*N. elongata* Grun. A. S. Atl. Pl. L, fig. 27—29).

N. Scopulorum Bréb. — Cape Deschnew (East Cape); a large specimen, 0,17 mm. in length, 0,01 mm. in breadth; striæ 23 in 0,01 mm.

Sectio: Quadriseriatæ.

N. subdivisa Grun. (A. Diat. pag. 29, Pl. I, fig. 20) Greenl., Mushroom Point, Kara, Cape Deschnew (East Cape).

A specimen from Cape Deschnew (East Cape) has 21 striæ in 0,01 mm. in the middle and 23 near the ends. Length 0,035 mm. Br. 0,005 mm.

N. latefasciata Grun. (A. Diat. Pl. I, fig. 21) Greenl., Mushroom Point, Kara, Cape Deschnew (East Cape).

Specimens from Cape Deschnew (East Cape) have not so strongly interrupted striæ as specimens from Kara.

N. grönländica Cl. (K. Sv. Vet. Ak. Handl. 18 No 5, pag. 7, Pl. I, fig. 13) Davis strait.

Sectio: Palpebrales.

N. palpebralis Bréb. var. Davis Strait. — Length 0,045 mm. Breadth 0,013 mm. Striæ 10 in 0,01 mm. costate, scarcely punctate.

var. *minor* Grun. (A. Diat. pag. 30, Pl. I, fig. 23) Finm.

A variety from Spitsbergen has 16 striæ in 0,01 mm. Length 0,04 mm. Breadth 0,008 mm. *N. minor* Greg.

N. semiplena (Grev.) Donk (Brit. Diat. Pl. IV, fig. 5) Finm., Spitsb. (Length 0,065 mm. Breadth 0,001 mm. Striæ 10 in 0,01 mm.).

N. solida Cl. (A. Diat. pag. 13, Pl. I, fig. 24) Finm.

Sectio: Amphisbæne.

N. brevis Greg. (Diat. of Cl. pag. 478, Pl. IX, fig. 4, A. Schm. N. Sea Diat. Pl. II, fig. 15) Greenl., Davis Strait, Finm., Spitsb., Cape Deschnew (East Cape).

var. *vexans* Grun. (A. Schm. N. Sea Diat. Pl. II, fig. 14) Finm., Matotschkin, Kara.

var. *distoma* Grun. (A. Diat. pag. 30, Pl. I fig. 25—26) Finm.

N. amphisbæna var. *fuscata* (Schum) Grun. (A. Diat. pag. 31, Pl. I, fig. 27) Kara.

N. subsalina Donk. (Brit. Diat. Pl. IV, fig. 2, *N. Fenzlii* Grun. *N. lacustris* Grun.) Greenl., Spitsb., Finm.

Sectio: Radiosæ.

N. flantica Grun. has been indicated in Cl. Diat. of the A. S. pag. 17 as an arctic species. I have, however, not found this species in reexamining my old slides, so there may be a mistake in the determination.

N. Gastrum (Ehb.?) Donk. (Van Heurck Syn. Pl. VIII, fig. 25 and 27) Kara, Cape Deschnew (East Cape) (Fresh-water species?).

var. *jenisejensis* Grun. (A. Diat. pag. 31, Pl. I, fig. 28) Cape Deschnew (East Cape).

N. digito-radiata Greg. (A. Schm. N. Sea Diat. Pl. III, fig. 4) Greenl., Mushroom Point, Finm., Spitsb., Kara.

N. peregrina (Ehb.?) Kütz. (Van Heurck Pl. VII, fig. 2, A. Schm. Atl. Pl. XLVII, fig. 57—60) Greenl., Mushroom Point, Kara, Cape Wankarema.

var.? *polaris* Ldt. (Bih. t. K. Sv. Vet. Ak. Handl. I, No 14, pag. 26, Pl. II, fig. 3) Kara.

N. valida Cl. at Grun. (A. Diat. pag. 32, Pl. II, fig. 29) Kara, Cape Wankarema.

In the latter locality *N. valida* occurs in a great profusion of varieties, which are all asymmetric, the striae on one half of the valve being more approximate to the median line than on the other. The striae are always distinctly transversely lineate. One variety *minuta* Cl. has not alternately longer and shorter striae in the middle. Striae 8 in 0,01 mm. Length of the valve 0,025 mm. Br. 0,013 mm. Typical specimens have the length 0,08 mm., the breadth 0,023 mm. and 8 striae, which in the middle are alternately longer and shorter. One variety is 0,11 mm. in length and 0,026 mm. in breadth, has 8 striae in 0,01 mm., scarcely alternately longer and shorter in the middle, and is very asymmetric. It comes near to *N. distans* var. *borealis* Grun, but has more dense striae. It approaches also fig. 17 and 18 in A. Schm. Atl. Pl. XLVI, which, however, are not distinctly asymmetric.

N. imperfecta Cl. — Broadly oval, 0,065 mm. in length and 0,03 mm. in breadth. Striae coarse, minutely transversely lineate, on one half of the valve more approximate to the med. line than on the other, shortened around the central nodule, 8 in 0,01 mm., interrupted. — Pl. 36, fig. 34. — Kara, Cape Wankarema.

This form comes near to *N. valida*, but differs in its striae, which are much less distinctly transversely lineate and many times interrupted, so that they seem to be composed of fragments.

N. Placentula var. *lanceolata* Grun. (A. Diat. pag. 34) Kara.

N. salinarum Grun. (A. Diat. pag. 33, Pl. II, fig. 34) Spitsb., Kara.

N. rhynchocephala Kütz (Grun. A. Diat. pag. 33) Kara, Cape Deschnew (East Cape).

N. bottnica Grun. (A. Diat. pag. 32, Pl. II, fig. 32) Finm.

Sectio: Directæ.

N. directa W. Sm. In the gatherings collected by Mr. Kjellman on the ice of Cape Wankarema occurs an almost incredible profusion of varieties and forms, all connected with each other and more or less akin to *N. directa*. Many of these forms are very different to the outline, number of striae, which are entire or more or less interrupted, always distinctly transversely lineate. Many of these forms are distinctly asym-

metric, others not. There are also closely allied forms, which have *arcuate* valves and therefore belong to *Rhoikoneis*. The *Rh. Bolleana* Grun. is really nearly allied to the group of *Nav. directa*. Although all the forms of this section in my opinion are nearly allied, it may be necessary to name them and arrange them.

To *N. directa* I refer all slender, or almost linear forms, about 10 times longer than broad, which have parallel striae, shortened around the central nodule.

var. *remota* Grun. (A. Schm. Atl. Pl. XLVII, fig. 2) striae 4—5 in 0,01 mm. — Finm., Spitsb., Kara (Matotschkin Schar).

var. *Incus* Grun. (A. Schm. Atl. Pl. XLVII, fig. 7 from the Mediterranean Sea) Striae 4 in 0,01 mm. very slightly radiant, on one half of the valve interrupted. I have not seen typical specimens from the Arctic Sea.

var. *angusta* Grun. (A. Diat. pag. 39) striae 8 in 0,01 mm. Greenl. (Mushroom Point), Finm., Spitsb., Kara, Cape Deschnew (East Cape). Seems to me to be the typical *N. directa* W. Sm.

var. *subtilis* Greg. (Pinnul.? subt. Greg. D. of Cl. pag. 488, Pl. IX, fig. 19) striae 9—11 in 0,01 mm. Spitsb., F. J. L., Cape Deschnew (East Cape), Cape Wankarema.

var.? *decussatim-striata* Grun. — F. J. L. (unknown to me).

N. transitans Cl. — Intermediate forms between *N. directa* and *N. Zostereti* Grun. Valves more or less abbreviate, lanceolate. Striae parallel or slightly radiant.

forma *genuina*. — 6 to 4 times longer than broad, lanceolate. Striae coarsely lineate, 8 in 0,01 mm. almost parallel, shortened around the central nodule. Length 0,065 to 0,09 mm. Breadth 0,016 mm. to 0,02 mm. — Cape Wankarema. — Pl. 36, fig. 31 and 33.

var. *derasa* Grun. (*Nav. derasa* Grun. A. Diat. pag. 39, Pl. II, fig. 46). Striae on both sides of the median line interrupted by a linear area, $8\frac{1}{2}$ —12 in 0,01 mm. in the middle, 10—14 near the ends, not so strongly transversely lineate as in typical specimens, (according to Grunow the striae are 10 in 0,01 mm. in the middle and 16 at the ends). Length 0,067 mm. Breadth 0,015 mm. — Kara, Cape Wankarema, Cape Deschnew (East Cape).

forma *minuta*. — Striae 12 in 0,01 mm., distinctly transversely lineate. Length 0,035 mm. Breadth 0,012 mm. — Cape Deschnew (East Cape). Pl. 36, fig. 37.

form. *gracilenta* Grun. l. c. Kara.

N. incudiformis Grun. (*N. Incus abbreviata* Grun. A. Diat.

pag. 39, Pl. II, fig. 43) Striæ 8 in 0,01 mm. on one half of the valve more approximate to the median line than on the other, and on this half interrupted. Length 0,095—0,05 mm. Valves sometimes arcuate.

Cape Wankarema. Pl. 36, fig. 26, 30.

This variety seems to connect *Nav. (Rhoikoneis) superba* Cl. with *N. transitans*.

N. Zostereti Grun. — More or less lanceolate. Striæ slightly radiant, distinctly transversely lineate; striæ 5 to 12 in 0,01 mm., more approximate at the ends.

forma *genuina* (A. Schm. Atl. Pl. XLVII, fig. 42—44 with about 7 striæ in 0,01 mm.). Specimens from Kara have 9 striæ in 0,01 mm. Length 0,1 mm. Breadth 0,02 mm.

var. *acutiuscula* Greg. (Pinn. acutiuscula Greg. T. M. Soc. IV, pag. 48, Pl. V, fig. 21) Striæ about 11 in 0,01 mm. — Kara. (Length 0,06 mm. Br. 0,01 mm.)

Nav. longa Greg. (l. c. fig. 18) with 5 str. in 0,01, may perhaps be regarded as a form of *N. Zostereti*, were not the median line described as generally twisted, which character seems to indicate that *N. longa* is a *Scoliopleura*.

N. erosa Cl. — More or less elliptic, about 5 times longer than broad, tapering regularly from the middle to the ends. Striæ coarse, $7\frac{1}{2}$ —10 in 0,01 mm., transversely finely lineate, a little radiant, interrupted, so that they have the appearance of being composed of fragments. Central nodule surrounded by a small area. Length 0,1 mm. Breadth 0,02 mm. — Pl. 36, fig. 28. — Cape Wankarema.

N. (Rhoikoneis) trigonocephala Cl. N. Sp. — Linear with parallel sides and cuneate, sometimes protracted ends. Valves often arcuate. Striæ coarse 10—12 in 0,01 mm., almost parallel, interrupted as in *N. erosa*, transversely lineate. Length 0,05—0,065 mm. Breadth 0,01—0,012 mm. — Pl. 36, fig. 29. — Cape Wankarema.

N. asymmetrica Cl. N. Sp. — Elongated elliptic, 4—5 times longer than broad. Striæ almost parallel, interrupted, $9\frac{1}{2}$ in 0,01 mm., transversely lineate, on one half of the valve reaching the median line, on the other ending at some distance from it. Length 0,1 mm. Breadth 0,023 mm. — Pl. 36, fig. 27. — Cape Wankarema.

Perhaps an asymmetric variety of *N. erosa*.

N. (Rhoikoneis) superba Cl. Valves rhombic, arcuate (or sometimes straight), convex and concave valves being more or less different. Striæ almost parallel, transversely lineate, on the

convex valve 9 in the middle, 10 in 0,01 mm. toward the ends, reaching almost to the median line; on the *concave* valve 8—10, on one side of the valve not reaching the median line, on the other reaching the median line, but interrupted by a linear area.

Length 0,06 mm. Breadth 0,02 mm. — Pl. 36, fig. 23.

Cape Wankarema.

var. *elliptica* Cl. Valve elliptic. Striæ parallel, 10 in 0,01 mm. Length 0,065 mm. Breadth 0,02 mm. — Pl. 36, fig. 24. — Cape Wankarema.

The concave valve of this variety is scarcely different from *N. incudiformis* Grun.

N. (Rhoikoneis) obtusa Cl. *N. Sp.* (*Rhoic. obtusa* Cl. in Cl. & Möll. Diat. 315—318) Elongated, linear, with rounded obtuse ends. Striæ curved, not parallel, very faintly lineate, on one half of the valve reaching the median line, on the other ending at some distance, irregularly interrupted, 11 in 0,01 mm. Length 0,075 mm. Breadth 0,014 mm. — Pl. 36, fig. 25. — Cape Wankarema.

N. (Rhoikoneis) Bolleana Grun. (*Verh.* 1863, pag. 147, Pl. XIII, fig. 11) Greenl., Spitsb., Finm., Kara (Matotschkin), Cape Wankarema.

Specimens from Greenland have 8 radiant striæ in 0,01 mm. in the middle, 12 near the ends. Specimens from Wankarema are less arcuate, have in 0,01 mm. 10 striæ, which are almost parallel. The striæ are transversely finely lineate as in all species of the *directa*-group. Mr. Grunow has named this variety from Wankarema *Rh. Bolleana* var.? *Siberica* (Cl. & Möll. Diat. No 302.) — Pl. 37, fig. 38. — Another variety from Cape Wankarema has asymmetric striation and 11 striæ in 0,01 mm. var. *asymmetrica* Cl. length 0,045 mm. breadth 0,01 mm. Pl. 37, fig. 39.

N. kariana Grun. (*A. Diat.* pag. 39, Pl. II, fig. 44) Kara, F. J. L., Cape Wankarema.

α. genuina Striæ 12—14 in 0,01 mm. Length 0,085 mm. Breadth 0,026 mm. — Kara, F. J. L., Cape Wankarema.

β. deterosa Grun. Mpt. Striæ interrupted on both sides of the median line by more or less broad areas. Length 0,09 mm. Breadth 0,024 mm. — Kara, F. J. L., Cape Wankarema. — Pl. 36, fig. 36.

γ. minor Grun. (*A. D.* pag. 5. *N. frigida* Grun. *A. D.* pag. 39) Striæ 16—18 in 0,01 mm. Length 0,044—0,07 mm. Breadth 0,012—0,013 mm. — Kara, F. J. L.

forma *curta* Cl. Length 0,03—0,04 mm. Breadth 0,009—0,01 mm. Striæ 12 in 0,01 mm. — Davis strait, Cape Wankarema. Cape Deschnew (East Cape). — Pl. 37, fig. 40.

N. kariana Grun. passes over to *N. transitans*, which scarcely differs in anything but coarser striæ and is by the latter connected with *N. Zostereti* and *N. directa*. According to Grunow the lineation of the striæ of *N. Kariana* forms longitudinal fine lines, which may be explained by the approximation of the striæ. Nearly allied to *N. Kariana* seems to me to be the following species.

N. subimpressa Grun. (A. Diat. pag. 39, Pl. II, fig. 45) Kara.
var.? *tenuior* Cl. Length 0,038 mm. Breadth 0,015 mm. Striæ 18 in 0,01 mm. — Pl. 37, fig. 49. — Cape Deschnew (East Cape).

N. distans Sm. (Syn. I, pag. 56, Pl. XVIII, fig. 169) Greenl., (Davis strait) Spitsb., Finm.

var. *borealis* Grun. (A. Diat. pag. 38, Pl. II, fig. 42) Spitsb., Finm.

Sectio: Retusæ.

N. fortis Greg. (A. Schm. Atl. Pl. XLVI, fig. 37—39) Greenl., Spitsb.

N. opima Grun. (A. Schm. Atl. Pl. XLVI, fig. 25—26) Greenl., (Davis strait).

N. jamalinensis Cl. (A. Diat. pag. 13, Pl. II, fig. 40) Jalmal, Cape Deschnew (East Cape).

N. cancellata Donk. var. *impressa* Ldt. (*N. impressa* Ldt. Bih. t. K. Sv. Vet. Ak. Handl. B. III, No 15, pag. 33, fig. 3) Greenl. (Davis strait), Finm., Kara.

var. *Gregorii* Grun. (A. Diat. pag. 37) Finm., Kara.

var. *subapiculata* Grun. (l. c.) Kara.

var. *Schmidtii* Grun. (l. c.) Spitsb., Cape Deschnew (East Cape).

var. *minuta* Grun. (l. c.) Finm., Cape Deschnew (East Cape).

N. inflexa Greg. (A. Schm. Atl. Pl. XLVI, fig. 69—70) Kara.

N. retusa Bréb. Cape Wankarema.

I give a delineation of a specimen from Cape Wankarema, according to Grunow the typic *N. retusa*. It has been drawn Pl. 36, fig. 35 a, b, from a dry specimen in two different foci.

Sectio: Decipientes.

N. Lundströmii Cl. (A. D. pag. 13, Pl. II, fig. 29) Kara.

N. plicata Donk. (B. D. Pl. IX, fig. 21) Kara.

N. subinflata Grun. Mpt. — Linear oblong, more or less gibbous in the middle, with rounded obtuse ends, very convex. Central striæ stronger and more distant, the others rather pa-

rallel, reaching the median line. Length 0,04 mm. Breadth 0,008 mm. — Pl. 37, fig. 50. — Greenl. (Bessel's Bay), Cape Wankarema.

Sectio: Punctatae.

N. pusilla Sm. var *jamalinensis* Grun. (A. Diat. pag. 40, Pl. II, fig. 40) Kara (Fresh-water species?).

N. marina Ralfs (Prit. Inf. pag. 903, W. Sm. Syn. I, pag. 52, Pl. XVI, fig. 151) Greenl. (Davis strait), Finm., Kara (Matotschkin).

N. cluthensis var.? *finmarchica* Grun. (A. Diat. pag. 40, Pl. II, fig. 49) Finm.

N. septentrionalis Cl. (A. Schm. Atl. Pl. VI, fig. 37) Greenl. (Mushroom Point), Spitsb., Kara (Matotschkin).

N. glacialis Cl. (Cocconeis gl. Cl. D. of the A. S. pag. 14, Pl. III, fig. 12, A. Schm. Atl. Pl. VI, fig. 35—39 typical) Greenl., Spitsb., Kara (Matotschkin, Jalmal), Cape Wankarema. In the latter locality there occur a number of varieties quite different from the typical form. In Pl. 37, fig. 41 I have figured a small variety, which seems to have very little to do with the typical forms.

N. humerosa Bréb. (A. Schm. Atl. Pl. VI, fig. 3—5) Finm., Spitsb., Kara (Jalmal).

N. latissima Bréb. (A. Schm. Atl. Pl. VI, fig. 7) Finm.

Sectio: Didymæ.

N. Bombus Ehb. (*N. gemina* A. Schm. N. Sea D. Pl. I, fig. 1) Finm.

N. splendida Greg. (T. M. S. IV, pag. 44, fig. 14) Greenl., Beeren Id, Finm., Spitsb.

N. interrupta Kütz (A. Schm. Atl. Pl. XII, fig. 1—5) Greenl., (Mushroom Point), Finm., Spitsb., Kara (Matotschkin, Jalmal).

N. didyma Kütz (A. Schm. Atl. Pl. XIII, fig. 1—3) Greenl. (Davis strait), Finm., Spitsb., Kara.

N. Crabro Ehb. (A. Schm. N. Sea Diat. Pl. I, fig. 5—6, Pl. II, fig. 4) Finm.

N. bomboides var. *media* Grun. (A. Diat. pag. 41, Pl. III, fig. 54) Greenl. (Mushroom Point), Finm., Spitsb., Kara (Matotschkin).

N. Donkinii A. Schm. (N. Sea Diat. Pl. II, fig. 8, Pl. I, fig. 12) Finm.

N. incurvata Greg. (A. Schm. N. Sea D. Pl. I, fig. 10—11, Pl. II, fig. 6) Finm.

N. subcineta A. Schm. (N. Sea D. Pl. II, fig. 7. *N. didyma* Ldt. Bih. t. K. Sv. Vet. Ak. Handl. III, No 15, pag. 37, fig. 4) Finm., Kara (Matotschkin).

Sectio: Ellipticæ.

N. littoralis Donk. (A. Schm. Atl. Pl. VIII, fig. 23—25) Greenl. (Mushroom Point) Finm., Kara, Cape Deschnew (East Cape).

N. Smithii Bréb. (A. Schm. Atl. Pl. VII, fig. 14—22) Greenl. (Mushroom Point) Finm., Spitsb., Kara (Matotschkin, Jalmal), Cape Deschnew (East Cape).

N. fusca Greg. (A. Schm. Atl. Pl. VII, fig. 1—4) Finm., Matotschkin Schar.

N. æstiva Donk. (A. Schm. Atl. VIII, fig. 26) Finm., Cape Wankarema.

N. suborbicularis Greg. (A. Schm. Atl. Pl. VIII, fig. 2—5) Greenl. (Davis strait).

N. Eudoxia A. Schm. (Atl. Pl. VIII, fig. 40) Cape Wankarema.

N. Tschuktschorum Cl. N. Sp. — Small, oval with rounded ends. The middle of the valve has, as in *N. Lyra*-section, two arcuate, convergent thickenings, connected by a transverse bar at the centre. The space between the margin and the thickenings has coarse, costate striæ, 13 in 0,01 mm. Length 0,01 mm. Br. 0,0065. — Pl. 37, fig. 48. — Cape Deschnew (East Cape).

This species comes nearest to *N. Reichardii* Grun. (Van Heurck Syn. Pl. X, fig. 9) which is larger and has closer, punctate striæ. The *N. Mauleri* R. J. Brun (Diat. des Alpes et du Jura Pl. I, fig. 18) is also an allied form, but more nearly related to *N. Borussica* Cl. (Schr. phys. oek. Ges. zu Königsberg Bd. XXII, pag. 139, A. Schm. Atl. Pl. VIII, fig. 17) in Domblitten deposit.

Sectio: Lyræ.

N. pygmæa Kütz. (A. Schm. N. Sea Diat. Pl. I, fig. 43) Finm., Spitsb., Kara, Cape Deschnew (East Cape).

N. abrupta Greg. (A. Schm. l. c. Pl. I, fig. 37) Finm., Spitsb.

N. hyalina Donk. (Brit. Diat. Pl. I, fig. 1) Finm.

N. forcipata Grev. (A. Schm. N. Sea Diat. Pl. I, fig. 45, Pl. II, fig. 16 & 18) Greenl. (Davis strait).

N. spectabilis Greg. (Diat. of Cl. pag. 481, Pl. IX, fig. 10) Greenl.

N. circumsecta Grun. (A. Schm. Atl. Pl. III, fig. 27—28) Finm.

N. Henedyi Sm. (A. Schm. N. Sea Diat. Pl. I, fig. 41) Greenl., Finm., Spitsb., Kara (Matotschkin).

N. Lyra Ehb. (A. Schm. Atl. Pl. II, fig. 16) Greenl., Finm., Spitsb., Kara (Matotschkin).

var. *elliptica* A. Schm. (N. Sea Diat. Pl. I, fig. 38—39) Greenl. (Mushroom Point), Finm., Kara.

N. kryophila Cl. — Elliptic oblong or elliptic with parallel sides. Striæ coarse, costate, about 8 in 0,01 mm., interrupted by large areas on both sides of the median line, over which areas the faint continuations of the striæ are visible. Length 0,05. Br. 0,018 mm. — Pl. 37, fig. 43. — Cape Wankarema.

N. (kryophila var.?) gelida Cl. — Elliptic. Striæ short, marginal, 9 in 0,01 mm., costate, separated from very short striæ on both sides of the median line by large areas, over which traces of the striæ are visible. Central nodule surrounded by a circular area. Length 0,08 mm. Breadth 0,04 mm. — Pl. 37, fig. 42. — Cape Wankarema.

Sectio: Pseudo-amphiprora.

N. arctica Cl. (K. Sv. Vet. Ak. Handl. XVIII, No 5, pag. 3) Finm., Kara (Matotschkin).

Sectio: Complexæ.

N. (Schizonema) Grevillei Ag. (Grun. A. Diat. pag. 42. Nav. Libellus Greg. *N. rhombica* Greg. Libellus *Grevillei* Cl. D. of the A. S. pag. 18) Greenl. (Bessel's Bay), Finm., Spitsb.

The largest specimen I have seen from Greenland measures 0,125 mm. in length and 0,024 mm. in breadth and has in the middle 15 striæ in 0,01 mm.

N. (Schizonema) comoides Grev. (Van Heurck Syn. Pl. XVI, fig. 3) Cape Deschnew (East Cape).

N. complanata Grun. (Amph. complanata Grun. A. Schm. Atl. Pl. XXVI, fig. 45) Finm., Kara.

Sectio: Minutulæ.

N. crassirostris Grun. (A. Diat. pag. 45, Pl. III, fig. 57) Kara.

var. maasöensis Grun. (l. c.) Finm.

N. kryokonites Cl. Elliptic, with obtuse ends. Striæ parallel, 22 in 0,01 mm., absent or obsolete in the middle of the valve. Length 0,034 mm. Breadth 0,011 mm. — Pl. 37, fig. 44. — Cape Wankarema.

var. subprotracta Cl. Rhombic with produced, subcapitate ends, striæ 22 in 0,01 mm. Length 0,033 mm. Breadth 0,007 mm. — Pl. 32, fig. 46. — Cape Wankarema.

var. semiperfecta Cl. Striæ 24 in 0,01 mm., covering one half of the valve, where they are of equal strength, and the other half, except in the middle, where they are obsolete. — Pl. 37, fig. 45. — Cape Wankarema.

N. (kryokonites var.?) wankaremæ Cl. Elongate lanceolate. Median line straight, central nodule small, terminal nodules near the ends. Striæ absent from the middle of the valve,

parallel, very fine, about 30 in 0,01 mm. — Pl. 37, fig. 47. — Cape Wankarema.

N. Baculus Cl. — Linear, elongate, with rounded ends. Median line broad. Central nodule small. Striæ parallel, 19 in 0,01 mm., absent from the middle of the valve, generally interrupted or as erased towards the middle. Length 0,065 mm. Breadth 0,007 mm. — Pl. 37, fig. 51. — Cape Wankarema.

This species seems to come near *N. Fistula* A. Schm. N. Sea Diat. Pl. II, fig. 29, which perhaps may be *N. inconspicua* Greg. Diat. of Cl. pag. 478, Pl. IX, fig. 3.

I do not know these two species. In some mediterranean gatherings I have seen a *Navicula* closely resembling *N. Baculus*, but with finer striæ, 26 in 0,01 mm., obsolete or absent from the middle of the valve, but not interrupted as in *N. Baculus*. Length 0,053, breadth 0,007 mm. It may perhaps be *N. Fistula*.

N. inornata Grun. (A. Diat. pag. 46, Pl. III, fig. 56. *N. Acus* Cl. l. c. pag. 14, Pl. III, fig. 55) Finm.

Sectio: Vanheurckia.

N. (Schizonema) vulgaris Thwaites — Kara (Fresh-water-species?).

Sectio: Vegæ.

N. Vegæ Cl. (*Pleurosigma Kjellmanii* Cl. A. D. pag. 14, Pl. IV, fig. 80) — Kara, Cape Wankarema.

var. *subconstricta* Grun. (in litt. c. icone) linear with parallel margins, constricted in the middle. Transverse striæ $15\frac{1}{3}$. Longitudinal striæ $14\frac{1}{3}$ in 0,01 mm. — Cape Wankarema.

Sectio: Decussatæ.

N. Placenta (Ehb.?) Lewis (Grun. A. Diat. pag. 47, Pl. III, fig. 60) Finm.

Nav. *Incertæ sedis.*

N. perlepada Grun. F. J. L. (unknown to me).

Stauroneis aspera Ehb. (*St. pulchella* W. Sm.), var. *intermedia* Grun. Greenl. (Bessel's Bay, Mushroom Point), Finm., Spitsb., Kara (Matotschkin), Cape Deshnew (East Cape).

St. finmarchica Cl. & Grun. (A. Diat. pag. 47, Pl. III, fig. 63) Finm., Kara, Cape Deshnew (East Cape).

St. scandinavica Ldt. (Bih. t. K. Sv. Vet. Ak. Handl. III, No 15, pag. 47. *Navic. lacustris* A. Schm. N. Sea Diat. Pl. I, fig. 29) Kara.

St. Spicula Dickie (Van Heurck Syn. Pl. IV, fig. 9) Greenl. (Discovery Bay), Spitsb., Cape Wankarema.

St. desiderata Cl. (A. Diat. pag. 14, Pl. III, fig. 58) Kara.

St. Gregorii Rolfs var. *obtusiuscula* Grun. (A. Diat. pag. 47, Pl. III, fig. 64) Kara.

St. pellucida Cl. — Broadly oval, with rounded, obtuse ends, membranaceous. Central nodule dilated in a short stauros. Striæ 20 in 0,01 mm., obsolete, punctate. Length 0,053. Breadth 0,023 mm. — Cape Wankarema. — Pl. 35, fig. 10.

St. pusilla Grun. — F. J. L. — Unknown to me.

St. perpusilla Grun. — F. J. L. — Unknown to me.

Scoliopleura tumida (Bréb.) Grun. (*Nav. tumida* Bréb. *N. Jenneri* W. Sm.) Kara.

Pleurosigma formosum W. Sm. — Greenl.

P. obscurum W. Sm. — Spitsb.

P. longum Cl. (D. of the A. S. pag. 19, Pl. III, fig. 14, Grun. Arct. Diat. pag. 49, Pl. I, fig. 71) Greenl., Finm., Spitsb., Kara (Matotschkin).

P. elongatum W. Sm. (Syn. I, pag. 64, Pl. XX, fig. 199) Kara (Matotschkin).

var. *fallax* Grun. (A. Diat. pag. 50, Pl. III, fig. 36) Greenl. (Davis Strait), Finm., Kara.

P. delicatulum W. Sm. (Syn. pag. 64, Pl. XXI, fig. 202) Finm., Spitsb., Kara.

var. *kariana* Grun. (A. Diat. pag. 50, Pl. III, fig. 69) Kara.

P. latum Cl. (A. Diat. pag. 14, Pl. III, fig. 68) Finm.

P. affine Grun. (A. Diat. pag. 51. *P. naviculaceum* Cl. D. of the A. S. pag. 19) Greenl. (Davis Strait), Finm., Spitsb.

P. angulatum W. Sm. (Syn. I, pag. 65, Pl. XXI, fig. 205) Greenl., Finm., Spitsb.

P. strigosum W. Sm. (Syn. I, pag. 64, Pl. XXI, fig. 203) Finm., Kara.

P. æstuarii Bréb. (W. Sm. Syn. I, pag. 65, Pl. XXXI, fig. 275) Finm.

P. finmarchicum Cl. (= *P. Normani* Cl. A. D. pag. 14, Pl. III, fig. 67) Finm.

P. Clevei Grun. (A. Diat. pag. 52, Pl. III, fig. 70) Kara.

var. *siberica* Grun (in litt. c. icone) Striæ, oblique and transverse, 28 in 0,01 mm. Cape Wankarema. Pl. 35, fig. 14.

P. nubecula W. Sm. (Syn. I, pag. 64, Pl. XXI, fig. 201) Finm.

P. intermedium W. Sm. (Syn. I, pag. 64, Pl. XXI, fig. 200) Finm., Spitsb.

var. *subrecta* Cl. (A. Diat. pag. 14, Pl. III, fig. 72) Greenl., Finm., Spitsb.

P. rigidum W. Sm. (Syn. I, pag. 64, Pl. XX, fig. 198) Greenl., Spitsb.

P. rhomboides Cl. (A. D. pag. 14, Pl. IV, fig. 73) Kara, Cape Wankarema, F. J. L.

var. *angustior* Grun. — F. J. L.

P. Stuxbergii Cl. & Grun. (A. Diat. pag. 54, Pl. IV, fig. 74) F. J. L., Kara, Cape Wankarema.

var.? *hyperborea* Grun. (transv. striæ $22\frac{1}{2}$ oblique $25\frac{1}{2}$ in 0,01 mm.)

P. distortum W. Sm. (Syn. I, pag. 67, Pl. XX, fig. 210) Spitsb. (longit. striæ 28, transverse 25 in 0,01 mm.).

P. Fasciola W. Sm. (Syn. I, pag. 67, Pl. XXI, fig. 211) Greenl., Finm., Spitsb., Kara.

var. *sulcata* Grun. (A. Diat. pag. 55, Pl. IV, fig. 75) Spitsb., Kara.

var. *tenuirostris* Grun. (A. Diat. pag. 55, Pl. IV, fig. 76) Kara.

P. balticum W. Sm. (Syn. I, pag. 66, Pl. XXII, fig. 207) Spitsb.

P. Wansbeckii Donk. (T. M. S. VI, pag. 24, Pl. III, fig. 7) Kara.

P. macrum W. Sm. (Syn. I, pag. 67, Pl. XXXI, fig. 276) Kara.

P. prolongatum W. Sm. (Syn. I, pag. 67, Pl. XXII, fig. 212) Spitsb., Kara.

P. tenuissimum W. Sm. (Syn. I, pag. 67, Pl. XXII, fig. 213) Spitsb., Kara.

var. *subtilissima* Grun. (A. Diat. pag. 58) Kara.

var. *hyperborea* Grun. (l. c.) Kara, Cape Wankarema.

P. Spenceri var. *borealis* Grun. (A. Diat. pag. 60, Pl. IV, fig. 79) Kara.

Of *P. Spenceri* I found in a sample from Hackluyts, Spitsb., a variety with 19 transverse and 24 longitudinal striæ, length 0,11, breadth 0,013 mm. In the Wankarema gatherings occurs another variety with 20 transverse and 26 longit. striæ in 0,01 mm., length 0,085 mm., breadth 0,008 mm.

P. vitreum Cl. (A. D. pag. 15, Pl. IV, fig. 78) Kara, Cape Wankarema (transverse striæ 19, longit. 20 in 0,01 mm.).

P. glaciale Cl. N. S. — Sigmoid, acute, med. line almost straight. Longit. and transverse striæ 28 in 0,01 mm. Length 0,143. Breadth 0,019 mm. — Pl. 35, fig. 13. — Cape Wankarema.

P. staurophorum Grun. A. Diat. pag. 61) Greenl. (Davis Strait).

Donkinia carinata (Donk.) Ralfs (Donkin T. M. S. VI, pag. 23, Pl. III, fig. 5) Greenl. (Davis strait, Length 0,1 mm. Breadth 0,02 mm. Oblique striæ 18 in 0,01 mm.) Finm.

D. minuta (Donk.) Ralfs (Donkin l. c. f. 8) Finm.

Rhoicosigma arcticum Cl. (D. of the A. S. pag. 18, Pl. III, fig. 16) Greenl., Finm., Spitsb., Kara (Matotschkin).

Specimens from Hackluyts, Spitsbergen, have 21—22 striæ in 0,01 mm.

R. Reichhardii Grun. (M. J. 1877, pag. 181, Pl. CXCIV, fig. 19) Kara, Cape Wankarema.

R. compactum (Grev.) Grun. (Pleuros. comp. Grev. M. J. V. pag. 12, Pl. IV, fig. 9) Kara.

Amphiprora (Plagiotropis) scaligera Grun. (A. D. pag. 66, Pl. V, fig. 90) Finm.

A. longa Cl. (Diat. A. S. pag. 20, Pl. III, fig. 15) Finm., Spitsb., Kara (Matotschkin).

A. maxima var. *dubia* Cl. & Grun. (A. Diat. pag. 65, Pl. V, fig. 89) Finm.

A. plicata v. *subplicata* Grun. (A. Diat. pag. 65, Pl. V, fig. 88) Kara, Cape Wankarema.

A. (amphitropis) paludosa W. Sm. — Greenl. (Discovery Bay) Finm.

var. *Pokornyana* Grun. (Verh. 1860, pag. 569, Pl. IV, fig. 9) Kara.

var.? *hyperborea* Grun. (A. Diat. pag. 62, Pl. V, fig. 86) Kara.

var.? *polaris* Grun. Mpt. — F. J. L.

var. *punctulata* Grun. (A. Diat. pag. 62, Pl. IV, fig. 84) Kara, Cape Wankarema.

var.? *borealis* Grun. (l. c. Pl. IV, fig. 85) Kara, Cape Wankarema.

var.? *duplex* Donk. (Van Heurck Syn. Pl. XXII, fig. 15—16) Greenl. (Discovery Bay), Spitsb.

A. (Amphitropis) Kjellmani Cl. (A. Diat. pag. 15, Pl. IV, fig. 83). Kara, Cape Wankarema.

A. (Amphitropis) kryophila Cl. — Large, median line strongly sigmoid. Junction-line between the keel and the carina wavy. Striæ on the carina ending in small puncta, 13—17 in 0,01 mm. closer than on the valve, 10—14 in 0,01 mm. Length 0,13—0,16 mm. Breadth of valve 0,017 mm. of frustle 0,043—0,045 mm., at the constriction 0,028—0,03 mm. — Pl. 35, fig. 11. — Cape Wankarema.

A. (Amphitropis?) glacialis Cl. — Frustle almost linear, very little constricted in the middle; junction-line between the carina and the valve wavy. Striæ on the keel 14 in 0,01 mm. more distant than on the valve, 19 in 0,01 mm. Pl. 35, fig. 12.

Length 0,07 mm. Breadth 0,015 mm. — Cape Wankarema. Perhaps a variety of the following.

A. (Amphitropis?) striolata Grun. (A. Diat. pag. 62, Pl. IV, fig. 81) Kara.

A. (Amphitropis?) kariana Grun. (A. Diat. pag. 61, Pl. IV, fig. 82) Kara.

A. (Amphitropis) decussata Grun. var. *septentrionalis* Grun. (A. Diat. pag. 63, Pl. V, fig. 87) Finm., Cape Wankarema.

Specimens from Wankarema are very large, 0,14—0,18 mm. in length, and have 20—22 striæ on the valve. Median line sigmoid.

7. Amphipleureæ.

Berkeleya Dillwynii Grun. (Van Heurck Syn. Pl. XVI, fig. 15) Spitsb., Kara, Cape Deschnew (East Cape) (striæ 24 in 0,01 mm).

8. Nitzschieæ.

Sectio: Tryblionella.

N. Tryblionella Hantzsch. (Grun. A. Diat. pag. 69) var. *Victoriæ* Grun. — Kara.

var. *levidensis* W. Sm. — Finm., Kara.

N. navicularis (Bréb.) Grun. (Trybl. marginata Sm.) Spitsb. — I have indicated this species in the D. of the A. S. as an inhabitant of the Arctic Sea, but not having afterwards found it, I am uncertain as to the exactness of the determination.

N. (?) seriata Cl. N. Sp. — Fusiform with gradually attenuated ends. Puncta indistinct. Striæ 16—18 in 0,01 mm. pervious. Frustules coherent in long bands. Length 0,09—0,11 mm. Breadth 0,008 mm. — Pl. 38, fig. 75. — Greenland, Tindingen (N. O. Holst).

I am very uncertain as to the exact position of this diatom, whose nearest allies seem to be *N.?* (*Homoeocladia*) *pungens* Grun. Mpt. (Cl. & Möll. Diat. No 307) from Japan, also the *Fragilaria (?) Cylindrus* Grun. Mpt.

Sectio: Panduriformes.

N. panduriformis Greg. var. *delicatula* Grun. (A. Diat. pag. 71, Pl. V, fig 92) Finm., Spitsb.

N. constricta Kütz. In the Diat. of the Arctic Sea I have indicated this species as occurring near Spitsbergen, but I cannot be sure of the correctness of the determination, not having found it afterwards.

Sectio: Apiculatæ.

N. marginulata Grun. a. *genuina* Grun. (A. Diat. pag. 72, Pl. V, fig. 93) Kara (Matotschkin).

var. *minuta* Grun. (l. c.) Cape Deschnew (East Cape) (length 0,045 mm. puncta 12 and striæ 24 in 0,01 mm.) Greenl. (Mushroom Point).

N. apiculata (Greg.) Grun. (A. Diat. pag. 73) Greenl., Finm.

Sectio: Dubiæ.

N. dubia W. Sm. (Grun. A. D. pag. 77) Kara, Cape Deschnew (East Cape).

In the East Cape gathering occurs a small form, only 0,065 mm. in length, with 8 puncta and 29 striæ in 0,01 mm.

N. Wankaremæ Cl. N. Sp. — Keel not very eccentric; carinal puncta 5—7 in 0,01 mm. absent in the middle, where there is an indication of a central nodule. Striæ very fine, about 30 in 0,01 mm. Length 0,15—0,17 mm. — Pl. 38, fig. 71. — Cape Wankarema.

Sectio: Bilobatæ.

N. hybrida Grun. (A. Diat. pag. 79) Spitsb., Finm., Kara.

var. *kryokonites* Cl. — Length 0,13. Carinal puncta 9 in 0,01 mm. Striæ very fine, about 30 in 0,01 mm. Keel not very eccentric. Valve slightly constricted in the middle. — Pl. 38, — fig. 65. Cape Wankarema.

var.? *pellucida* Grun. (A. Diat. pag. 80, Pl. V, fig. 96) Finm.

N. Mitchelliana Greenl. (Grun. A. Diat. pag. 80, Pl. V, fig. 97) Finm., Spitsb., Kara.

Sectio: Pseudo-amphiprora.

N. Amphiprora Grun. (A. Diat. pag. 81. Amphipr. Nitzschoides Cl. D. of A. S. pag. 20, Pl. IV, fig. 18) Greenl., Spitsb., Cape Deschnew (East Cape).

Sectio: Insignes.

N. insignes var. *arctica* Grun. (A. D. pag. 84) Greenl., Finm., Spitsb., Kara (Matotschkin).

var.? *marginifera* Grun. (A. Diat. pag. 84. Pl. VI, fig. 105) Finm.

Sectio: Bacillaria.

N. socialis Greg. (Van Heurck Syn. Pl. LXI, fig. 8) Greenl., Finm., Kara (Matotschkin).

var. *kariana* Grun. (A. Diat. pag. 85, Pl. VI, fig. 108) Greenl. (Davis strait), Kara.

var. *baltica* Grun. (l. c. fig. 107) Kara, Cape Wankarema.

N. paradoxa (Gmel) Grun. (Van Heurck Syn. Pl. LXI, fig. 6) Kara.

Sectio: Vivaces.

N. (vivax var.?) hyperborea Grun. (A. D. pag. 86, Pl. V. fig. 104) Kara.

var.? *Nyströmii* Grun. (Cl. & M. Diat. No 172) Greenl. (Davis Strait), not known to me.

Sectio: Spathulatae.

N. angularis W. Sm. (Van Heurck Syn. Pl. LXII, fig. 11—14) Greenl., Finm., Kara (Matotschkin), Cape Deschnew (East Cape).

var. *borealis* Grun. (A. Diat. pag. 89, Pl. V, fig. 99) Finm., Kara.

var. *kariana* Grun. (l. c. p. 89, fig. 100) Kara.

N. spathulata Bréb. (Van Heurck Syn. Pl. LXII, fig. 7—8) Greenl. (Davis Strait), Finm.

var. *hyalina* Greg. (Van Heurck Syn. l. c. f. 9) Kara.

Sectio: Sigmoideae.

N. macilenta Greg. — In the Diat. of the A. S. I have indicated this species as occurring near Spitsbergen, but, not having met this species again, I think it may be a mistake.

N. Brebissonii var. *borealis* Grun. (Cl. & M. Diat. 316—318) Striæ 14—16 in 0,01 mm. Cape Wankarema.

Sectio: Sigmata.

N. Sigma Sm. (*Amphipleura rigida* Cl. D. of the A. Sea pag. 26. *Amphipleura sigmoidea* W. Sm.) Greenl., Finm., Spitsb.

N. (Sigma var.?) scabra Cl. — Valve large, in length 0,17—0,2 mm. breadth 0,01 mm., slightly sigmoid, or almost straight. Keel eccentric. Puncta about 4 in 0,01 mm. Striæ not seen, but the surface of the valve is covered by scattered puncta, which give it a shagreen-like appearance. — Pl. 38, fig. 73 a. b. — Cape Wankarema.

N. lævissima Grun. Mpt. — Greenl. (Discovery Bay), F. J. L., Cape Wankarema.

Sectio: Obtusae.

N. (obtusae var.??) kryophila Cl. Linear, slightly sigmoid toward the ends. Puncta 8, absent in the middle, where there is a small central nodule. Striæ 20 in 0,01 mm., composed of puncta. Length 0,14 mm. Breadth 0,006 mm. — Pl. 38, fig. 74. — Cape Wankarema.

Sectio: Lineares.

N. gelida Cl. & Grun. Straight with cuneate ends. Keel tolerably eccentric. Carinal puncta 6—8 in 0,01 mm., distant in the middle, where there is a distinct central nodule. Striæ composed of somewhat elongate puncta, which form irregularly wavy lines, 20—24 in 0,01 mm. Length 0,14 mm. Breadth 0,012 mm. — Pl. 38, fig. 70. — Cape Wankarema.

N. (recta var.?) polaris Grun. — Valve tolerably eccentric, linear with obtuse ends. Carinal puncta 7 in 0,01 mm., distant

in the middle. Striæ very fine. Length 0,075 mm. Breadth 0,006 mm. — Pl. 38, fig. 72. — F. J. L., Cape Wankarema.

N. linearis var. *tenuis* Grun. (A. D. pag. 93) Kara, Cape Wankarema. (Specimen from the latter locality have 11—12 puncta and 28—30 striæ in 0,01 mm. Length 0,13 mm. Breadth 0,009 mm.).

N. vitrea Norm. (Van Heurck Syn. Pl. LXVII, fig. 10) Spitsb. var. *finmarchica* Grun. (A. D. pag. 94, Pl. VI, fig. 106) Finm.

In the Wankarema gathering occurs a variety of *N. vitrea* 0,12 mm. in length 0,006 mm. in breadth with 8—10 puncta in 0,01 mm. and very fine striæ. In the Discovery Bay gathering occurs another variety with 8—9 puncta and 25 striæ in 0,01 mm.

N. frigida Grun. (A. Diat. pag. 94, Pl. V, fig. 101) Greenl. (Discovery Bay), Kara.

Sectio: Lanceolatae.

N. lanceolata var. *pygmæa* Cl. — Lanceolate, length 0,045 mm. Breadth 0,006 mm. Puncta 12 in 0,01 mm. Striæ very fine. — Cape Wankarema.

Seems to connect *N. lanceolata* with *N. acicularis*.

N. ovalis Arn. (Grun. A. Diat. pag. 95, Pl. V, fig. 103) Kara.

Sectio: Nitzschiella.

N. Closterium (Ehb.) W. Sm. (Van Heurck Syn. Pl. LXX fig. 5) Finm., Spitsb., Kara.

N. acicularis W. Sm. (Van Heurck Syn. l. c. fig. 6) Kara, Cape Wankarema.

Hantzschia amphioxys (Ehb.) Grun. — Kara (Fresh-water species). var. *vivax* Grun. (A. Diat. pag. 103) Kara.

H. Weiprechtii Grun. (A. Diat. pag. 104, *Nitzschia* Weipr. Grun. in Van Heurck Syn. Pl. LXII, fig. 16) F. J. L.

H. virgata Roper var.? *borealis* Grun. (A. Diat. pag. 104, Pl. VI, fig. 110) Kara.

var.? *kariana* Cl. & Grun. (l. c. fig. 109) Kara.

H. marina (Donk.) Grun. (Van Heurck Syn. Pl. LVI, fig. 14—15) Greenl. (Davis Strait).

9. Surirellæ.

Surirella Smithii Ralfs (*S. constricta* W. Sm. Syn. I, pag. 31, Pl. VIII, fig. 59) Finm.

S. fastuosa var. *lepida* A. Schm. (Atl. Pl. IV, fig. 7) Finm.

S. Gemma Ehb. (Van Heurck Syn. Pl. LXXIV, fig. 1) Spitsb.

S. ovata Kütz. (Van Heurck Syn. Pl. LXXIII, fig. 5—7) Spitsb.
Campylodiscus Helianthus A. Schm. (Atl. Pl. XVII, fig. 15) Spitsb., Kara (Matotschkin Schar).

C. grönlandicus Cl. (D. of A. Sea pag. 13, Pl. II, fig. 9) Greenl.

C. angularis Greg. (A. Schm. Atl. Pl. XVIII, fig. 7) Greenl., Finm., Spitsb., Kara (Matotschkin).

C. Ralfsii W. Sm. (Syn. I, pag. 30, Pl. XXX, fig. 257) Greenl. (Davis Strait).

C. Thureti Bréb. (*C. simularis* Greg. *C. bicruciatum* Greg.) Greenl., Spitsb., Finm., Kara (Matotschkin).

C. echineis Ehb. (*C. Argus* Bail. *C. cribratus* Sm.) Spitsb.

10. *Synedrea*.

Synedra nitzschioides Grun. (Verh. 1862, pag. 403, Pl. VIII, fig. 18) Greenl. (Davis Strait, Bessel's Bay [Length 0,06 mm., breadth 0,003 mm. Striæ 11 in 0,01 mm.] Mushroom Point), Spitsb.

var. *minor* Grun. (Nov. pag. 95, Pl. A. fig. 7) Kara.

S. tabulata Kg. (W. Sm. Syn. I, pag. 72, Pl. XII, fig. 96) Greenl. (Bessel's Bay. Length 0,115 mm. Breadth 0,005 mm. Striæ 9½ in 0,01 mm.), Spitsb., Kara.

var. *angusta* Grun. (A. Diat. pag. 105) Finm.

S. affinis Kütz. — Greenl. (Mushroom Point, Bessel's Bay, a variety, length 0,24 mm., breadth 0,0009, striæ 19 in 0,01 mm.) Finm., Spitsb., Cape Deschnew (East Cape).

var. *delicatula* Grun. (A. D. pag. 105, Pl. VI, fig. 115) Finm.

var. *borealis* Grun. — Finm.

S. hyperborea Grun. Mpt. — F. J. L.

var. *brevis* Grun. — F. J. L.

var. *flexuosa* Grun. — F. J. L.

var. *rostellata* Grun. — F. J. L.

S. investiens W. Sm. — Greenl. (Striæ 13 in 0,01 mm. Length 0,05 mm. Breadth 0,006 mm.) F. J. L.

S. kamtschatica Grun. (Verh. 1862, pag. 404, Pl. VIII, fig. 6) Greenl. (Davis Strait, Bessel's Bay, Mushroom Point), Finm., Spitsb., Kara (Matotschkin), East Cape.

var. *minor* Grun. (A. Diat. pag. 106) Greenl. (Bessel's Bay), Finm.

var. *intermedia* Grun. (l. c. Pl. VI, fig. 111) Finm.

var. *Kjellmanii* Cl. & Grun. (l. c. fig. 112) Finm.

var. *connectens* Grun. (l. c.) Finm.

var. *finmarchica* Cl. & Grun. (l. c. fig. 113) Finm.

S. commutata Grun. (A. D. pag. 107, Pl. VI, fig. 118) Greenl. (Mushroom Point, striæ 12 in 0,01 mm.). Finm.

S. fasciculata Kütz (Grun. A. Diat. pag. 105, Pl. VI, fig. 114) Finm.

S. parva Kütz. — Finm.

var. *major* Grun. (A. Diat. pag. 106, Pl. VI, fig. 117) Finm.

S. pulchella Kütz. — Finm.

var. *minutissima* (W. Sm.) Finm.

var. *Vertebra* Greg. — Finm.

S. crystallina (Ag.) Sm. (Syn. I, pag. 74, Pl. XII, fig. 101) Finm.

S. superba var. *minor* Grun. (A. Diat. pag. 108) Finm.

Sceptroneis marina (Greg.) Grun. (Van Heurck Syn. Pl. XXXVII, fig. 2) Finm.

S.? *gemmata* Grun. (Van Heurck Syn. Pl. XXXVII, fig. 3) »Arctic Ocean».

Thalassiothrix longissima Cl. & Grun. (A. D. pag. 108) North Atlantic Ocean, Cape Wankarema.

Th. Fraunfeldii var. ? *arctica* Grun. (Van Heurck Syn. XXXVII, fig. 14) North Atlantic Ocean.

Th. Fr. var. ? *tenella* Grun. (l. c. fig. 15) North Atlantic Ocean.

II. Plagiogrammæ.

Plagiogramma staurophorum (Greg.) Heib. (P. Gregorianum Grev. Dentic. stauroph. Greg. D. of Cl. pag. 496, Pl. X, fig. 37) Greenl. (Davis Strait) Finm.

B. Coccochromaticæ.

12. Fragilarieæ.

Fragilaria oceanica Cl. (Diat. of the A. S. pag. 22, Pl. IV, fig. 25. *F. arctica* Grun. A. Diat. pag. 110, Pl. VII, fig. 124) Greenl. (Tindingen, Bessel's Bay) Northern Atlantic Ocean, Kara.

A careful examination has proved the identity of *F. oceanica* Cl. and *F. arctica* Grun., and that my figure in D. of

A. S. is somewhat incorrect. The striæ are pervious as in Grunow's delineation.

F. islandica Grun. (Van Heurck Syn. Pl. XLV, fig. 37) Jan Mayen.

var. *hyperborea* Cl. — Area longer, striæ 12 in 0,01 mm. — Greenl., Bessel's Bay.

F.? *Cylindrus* Grun. Mpt. — Small, linear with parallel sides and broadly rounded ends. Striæ pervious 14—21 in 0,01 mm. Length 0,035—0,06 mm. Breadth 0,002—0,004 mm. — Pl. 37, fig. 64 a. b. c. — Greenl., Tindingen, F. J. L., Cape Wankkerema.

Grammonema striatulum Ag. (Sm. Syn. II, pag. 23, Pl. XXXV, fig. 298) Greenl., Finm., Spitsb.

13. Meridioneæ.

Asterionella kariana Grun. (A. Diat. pag. 110, Pl. VI, fig. 121) Kara.

14. Tabellarieæ.

Grammatophora oceanica (Ehb.) Grun. (*G. macilenta* W. Sm.) Greenl.

G. arctica Cl. (öfvers. K. Sv. V. Ak. Förh. 1867, pag. 664, Pl. XXIII, fig. 1. Van Heurck Syn. LIII B., fig. 3) Greenl. (Bessel's Bay, Assistance Bay etc.), Finm., Spitsb., Kara (Matotschkin).

G. arcuata Ehb. (Grun. Verh. 1862, pag. 420, Pl. XI, fig. 7) var. *arctica* Grun. (Bot. Centr. Bl. 1881, Bd VII, pag. 3) Greenl., Spitsb., Kara (Matotschkin), East Cape.

G. angulosa var. *islandica* (Ehb.) Grun. (Van Heurck Syn. Pl. LIII, fig. 7) Greenl. (Bessel's Bay), Finm., Spitsb., Kara (Matotschkin).

Rhabdonema Torellii Cl. (D. of the A. Sea pag. 24, Pl. IV, fig. 20) Greenl. (Bessel's Bay), Spitsb.

R. arcuatum (Lyngb.) (W. Sm. Syn. II, pag. 34, Pl. XXXVIII, fig. 305) Greenl. (Bessel's Bay), Finm., Spitsb., Kara (Matotschkin), Cape Deschnew (East Cape).

R. minutum (Kg.) (Sm. Syn. II, pag. 35, Pl. XXXVIII, fig. 306) Greenl., Finm., Spitsb., Kara (Matotschkin).

The *Rh. adiaticum* (Kg.) has been found once in a sample from Grötsund in Finmarken, but in no other arctic gathering.

Striatella unipunctata (Lyngb.) Sm. (Syn. II, pag. 37, Pl. XXXIX, fig. 307) Finm.

St. chilensis Grun. (Nov. pag. 96, Pl. I A., fig. 7) Greenl.

Only one frustle has been observed, so that it may be doubtful as an arctic species.

St. delicatula Kütz. var. *rectangula* Kütz. (Van Heurck Syn. Pl. LIV, fig. 3) Greenl., Bessel's Bay.

15. Licmophoreæ.

Licmophora grandis (Kütz.) Grun. (Van Heurck Syn. Pl. XLVIII, fig. 2) Spitsb. (Hackluyts) Striæ at the base 22 in 0,01, at the top 24 in 0,01 mm. Length 0,11 mm. Breadth 0,027 mm.

L. Jürgensii (Kütz.) Grun. (Van Heurck Syn. Pl. XLVI, fig. 10—11) Greenl. (Bessel's Bay) Kara.

var. *finmarchica* Grun. (A. Diat. pag. 110, Pl. VII, fig. 125) Finm.

L. borealis (Kütz.) Grun. — Kara (sec. Grun.).

L. nubecula (Kütz.) Grun. — Kara (sec. Grun.).

L. flabellata Ekb. forma brevior — Finm. (sec. Grun.).

L. elongata (Kütz.) Grun. — This species has been indicated by myself as occurring in Finmarken, but I have some doubts about the correctness of the determination.

16. Biddulphieæ.

Triceratium, Biddulphia.

B. aurita (Lyngb.) Bréb. (Sm. Syn. II, pag. 49, Pl. XLV, fig. 319) Greenl. (Bessel's Bay, Mushroom Point), Finm., Spitsb., Kara (Matotschkin), Cape Wankarema.

B. Rhombus Ehb. (Sm. Syn. II, pag. 49, Pl. XLV, fig. 320) Finm.

B. Balæna (Ehb.) Btw. (M. J. VII, pag. 18, Pl. IX, fig. 15. *Zygoceros radiatus* Bail. Smith's Contr. VII, Pl. II, fig. 29. *Triceratium arcticum* Btw. l. c. triangular form) Greenl. (Bessel's Bay), Finm., Spitsb., Kara.

var. *T. spitsbergense* Grun. (A. Diat. pag. 111) Spitsb.

T. finmarchicum Grun. (A. Diat. pag. 112, Pl. VII, fig. 126) Finm.

Actinocyclus alienus Grun. (Cl. & Möll. Diat. No 319) Cape Wankarema. — Unknown to me.

Coscinodiscus Oculus Iridis Ehb. — Greenl., Spitsb., Cape Wankarema.

var. *borealis* Bail. — Cape Wankarema.

C. radiatus Ehb. — Greenl. (Davis Strait), Beeren Eiland, Finm., Spitsb.

C. concinnus Roper (M. J. VI, pag. 20, Pl. III, fig. 12) Spitsb., Cape Wankarema.

C. centralis Ehb. (Greg. Diat. of Cl. pag. 501, Pl. XI, fig. 49) Spitsb., Greenl., Tindingen (A. Schm. Atl. Pl. LXIII, fig. 1).

var. *micraster* Grun. (Cl. and Möll. Diat. No 172) Davis Strait.

C. subtilis Ehb. (A. Sch. Atl. LVII, fig. 13—14) Greenl., Finm., Kara (Jalmal), Cape Wankarema.

C. excentricus Ehb. — Greenl. (Davis Strait), Spitsb., Kara, Cape Wankarema.

C. lineatus Ehb. — Beeren Ed, Spitsb., Finm., Kara (Jalmal).

C. nitidus Greg. (A. Schm. N. Sea Diat. Pl. III, fig. 32) Greenl. (Davis Strait), Finm.

C. subglobosus Cl. and Grun. (Cl. and Möll. Diat. No 172, A. Schm. Atl. Pl. LVIII, fig. 44) Greenl. (Davis Strait), Cape Wankarema.

C. (Odontodiscus) curvatulus Grun. (A. Schm. Atl. Pl. LVII, fig. 33) Greenl. (Davis Strait), F. J. L., Cape Wankarema.

C. Normanni Cl. D. of A. S. pag. 6 is only a variety of *C. curvatulus*.

var. *kariana* Grun. (A. Diat. pag. 113, Pl. VII, fig. 129) Finm., Kara.

var. *frigida* Grun. — F. J. L.

C. concavus Greg. (D. of Cl. pag. 500, Pl. X fig. 47) Kara.

C. (Odontodiscus) polyacanthus Grun. (A. D. pag. 112, Pl. VII, fig. 127) Greenl. (Tindingen) Kara (Jalmal).

C. (Odontodiscus) hyalinus Grun. (A. D. pag. 113, Pl. VII, fig. 128) Greenl. (Tindingen) F. J. L., Kara, Cape Wankarema.

C. (Odontodiscus) bioculatus Grun. Mpt. — Greenl. (Tindingen), F. J. L., Cape Wankarema.

C. (Odontodiscus) pellucidus Grun. (in Cl. & Möll. Diat. No 172) Davis Strait, Cape Wankarema.

Valve very thin and transparent, 0,065—0,08 mm. i diameter, covered with small puncta, arranged in repeatedly branching lines (16 in the middle and 20 in the margin on 0,01

mm.) Centre with some small, scattered puncta. Margin with small spines (6 in 0,01 mm.).

C. (Odontodiscus) granulatus Grun. (A. D. pag. 113, Pl. VII, fig. 130) Finm., Kara.

C. (Odontodiscus) lacustris Grun. (A. D. pag. 114) Matotschkin Schar, Kara.

var. *marinus* Grun. (in Cl. & Möll. Diat. No 172) Davis Strait.

var. *hyperboreus* Grun. (Cl. & Möll. Diat. No 315—18) with coarser puncta. — Cape Wankarema.

C. bathyomphalus Cl. N. Sp. — Disc 0,02—0,03 mm. in diameter, with funnel-shaped centre. Puncta arranged in lines, radiating from the centre to the margin, where they become smaller. — Pl. 38, fig. 81, — Spitsb., Cape Wankarema.

Stephanodiscus Hantzschii Grun. var. *pusilla* (A. D. pag. 115, Pl. VII, fig. 132, Van Heurck Syn. Pl. XCV, fig. 11) Finmark.

Thalassiosira Nordenskiöldii Cl. (Van Heurck Syn. Pl. LXXXIII, fig. 9) Greenl., Northern Atlantic Ocean, Finmarken, Spitsbergen, Kara, Cape Wankarema.

Hyalodiscus scoticus (Kg.) Grun. (A. D. pag. 116) Greenl. (Bessel's Bay, Mushroom Point) Finm., Spitsb., East Cape.

Podosira hormoides Mont. (Van Heurck. Syn. Pl. XXXIV) Greenl. (Mushroom Point).

var. *adriatica* (Kütz.) Grun. — Finm.

P. maxima (Kütz.) Grun. (Casp. Sea Alg. pag. 33. A. D. pag. 118, Hyal. arcticus Cl. & Möll. Diat. No 1. H. stelliger D. of A. S. pag. 4) Greenl., Finm., Spitsb., Matotschkin Schar, Cape Deschnew (East Cape).

Skeletonema mirabile Grun. (Cl. & Möll. Diat. No 318) Cape Wankarema.

I have seen of this species only a sketch, sent by Mr. Grunow. It has the appearance of a chain of auxospores of some *Chaetoceros*, but not having seen a specimen I cannot say anything about it.

Melosira nummuloides (Lyngb.) Kütz. — Greenl., Finm., Spitsb., Kara.

var. *hyperborea* Grun. (*M. arctica* Dickie) Van Heurck. Syn. Pl. LXXXV, fig. 3—4) Discovery Bay, Novaia Zemlia.

M. sulcata (Ehb.) Kütz. (*Paralia sulcata* Cl.) Finm., Kara.

var. *siberica* Grun. (Van Heurck Syn. Pl. XCI, fig. 22) F. J. L.

var. *biseriata* Grun. (Van Heurck Syn. l. c. fig. 23—24) F. J. L.

M. (mediterranea Grun. var.?) *gelida* Cl. — Surface of the valve covered near the margin with puncta arranged in curved lines crossing each other, about 25 in 0,01 mm. Diam 0,02—0,03 mm. Pl. 38, fig. 83 a. b. — Mushroom Point.

M. ornata Grun. (Van Heurck Syn. XCI, fig. 19—21) F. J. L.

M. Borreri Grev. (Van Heurck Syn. Pl. LXXXV, fig. 5—7) Greenl., Bessel's Bay.

II. Surface-diatoms from the Behring Sea.

Dr. Kjellman has collected in the Behring Sea diatoms living on the surface. The gathering contained:

Thalassiothrix longissima Cl. & Grun. in great abundance.

Coscinodiscus borealis Bail. (A. Schm. Atl. LXIII, fig. 11).

Endictya oceanica Ehb.

Chaetoceros atlanticus Cl.

Rhizosolenia styliformis Btw.

Rh. hebeta Bail.

III. Fresh-water diatoms from Japan.

In Japan Dr. Kjellman made some gatherings of fresh-water diatoms, interesting because most of the species were perfectly identical with European ones. I have observed the following species, of which the greater part has been determined with the aid of Van Heurck's synopsis:

Amphora affinis Kütz.

Cymbella cuspidata Kütz. Length 0,092. Breadth 0,024 mm. Striæ 10 in the middle, 12 near the ends.

C. affinis Kütz.

C. gastroides Kütz.

C. cymbiformis Ehb.

C. Cistula Hempr.

C. tumida Bréb.

Eucyonema cæspitosum Kütz.

Epithemia gibba (Ehb.).

E. gibberula Kütz.

- E. Sorex* Kütz.
E. Zebra (Ehb.).
Anchanthes lanceolata Bréb.
A. minutissima var. *cryptocephala* W. Sm.
Cocconeis Placentula Ehb.
Gomphonema constrictum var. *capitatum* Ehb.
G. gracile Ehb.
G. angustatum Grun.
G. parvulum Kütz.
Stauroneis anceps Ehb.
Navicula major Kütz.
N. viridis Kütz.
N. Legumen (Ehb.).
N. borealis (Ehb.).
N. Brébissonii Kütz. var.
N. bicapitata Ldt.
N. Cymbula Donk.
N. lanceolata Kütz.
N. cryptocephala Kütz.
N. amphiceros Kütz.
N. tenella Bréb.
N. dicephala W. Sm.
N. elliptica Kütz.
N. humilis Donk.
N. cuspidata Kütz.
N. ambigua Ehb.
N. limosa var. *ventricosa* Donk.
N. fasciata Ldt.
N. affinis Ehb.
N. Pseudobacillum Grun. (Arct. Diat. pag. 45, Pl. II, fig. 52).
N. Pupula (Kütz.) Grun.
N. Seminulum Grun.
N. binodis W. Sm. (Brit. D. XVII, fig. 159).
Schizonema vulgare Thw.
Amphipleura pellucida (Ehb.).
Pleurosigma Kützingii Grun. (Arct. Diat. pag. 59) Transv. striæ 21, longitudinal 26 in 0,01 mm.
Syneda Ulna Nitzsch var.
S. Acus var. *tenuissima* Grun.
Staurosira brevistriata Grun.
St. mesolepta Rabh.
Nitzschia (Tryblionella) Levidensis W. Sm.
 var. *Victoriæ* Grun.

N. sigmoidea (Ehb.)

N. intermedia Hantzsch.

N. Denticula Grun. var. minor, lanceolata, costis abbreviatis. A very remarkable variety with costæ not reaching half-way across the valve, 6 in 0,01 mm. and 17 striæ in 0,01 mm. Pl. 37, fig. 68. It is only on the authority of Mr. Grunow that I have accepted the determination as a variety of *N. Denticula*.

N. Tabellaria Grun.

Hantzschia amphioxys var. *californica* Grun. (A. Diat. pag. 103).

Surirella elegans Ehb.

S. saxonica Auersw. (A. Schm. Atl. Pl. XXII, fig. 1—2).

S. linearis W. Sm. (A. Schm. Atl. Pl. XXIII, fig. 27—33).

S. apiculata W. Sm. (A. Schm. Atl. Pl. XXIII, fig. 34—35).

Cymatopleura Solea (Bréb.) W. Sm.

Cyclotella comta Ehb.

Melosira varians Agardh.

IV. Diatoms from Labuan.

During the stay of the *Vega* in Labuan near Borneo Dr. Kjellman made some gatherings of marine algæ, among which was found a number of diatoms, which I have examined. I have registered the following forms:

Amphora ostrearia Bréb. (H. L. Smith Lens II, p. 72, Pl. I, fig. 16. — A. Schmidt Atl. Pl. XXVI, fig. 23? striæ not punctate!) This very variable species occurs in many forms, described as distinct species, as *A. vitrea* Cl. *A. quadrata* Bréb. *A. elegans* Greg. *A. membranacea* W. Sm. and Roper. *A. littoralis* Donk. Specimens from Labuan have 12 striæ in 0,01 mm., composed of distinct, separate puncta. Length of the valve 0,095 mm.

var. *Porcellus* (*A. Porcellus* Kitton in A. Schm. Atl. Pl. XXXIX, fig. 15—17. *A. novæ caledoniæ* Grun. l. c. Pl. XXVI, fig. 16 — conf. Grun. Arct. Diat. pag. 25). The variety from Labuan has the outline of *A. arcuata* (A. Schm. Atl. Pl. XXVI, fig. 27—29) but has much coarser striæ, composed of distinct puncta, 9 in 0,01 mm. Length 0,06 mm.

A. Weissflogii A. Schm. (Atl. Pl. XXV, fig. 58) Striæ 11 in 0,01 mm. Length 0,075 mm.

A. Schmidtii Grun. (A. Schm. Atl. XXVIII, fig. 2).

A. turgida Greg. (Diat. of Clyde. pag. 510, Pl. XII, fig. 63. *A. recta* Leud. Fortm. Ceyl. pag. 21, Pl. I, fig. 14). Length of the frustle 0,024 mm. Br. 0,015 mm. Striæ 12 in 0,01 mm.

A. cymbifera Greg. — Length 0,09 mm. Striæ 9 in 0,01 mm.

A. cymbelloides Grun. (Hedwigia 1867, VI, pag. 24, Cl. & Möll. Diat. No 147).

A. Javanica A. Schm. (Atl. XXVII, fig 27).

A. Proteus Greg. (Diat. of Clyde pag. 518, Pl. XIII, fig. 81).

var. *robusta* Greg. (*A. robusta* A. Schm. Atl. Pl. XXVII, fig. 39—41).

var. *mexicana* A. Schm. (*A. mexicana* A. Schm. Atl. Pl. XXVII, fig. 47—48).

A. obtusa Greg. (A. Schm. Atl. Pl. XL, fig. 16—17).

A. furcata Leuduger Fortm. (Diat. de Ceylon pag. 20, Pl. I, fig. 11. *A. spectabilis* A. Schm. Atl. Pl. XL, fig. 20—23).

A. labuensis Cl. N. Sp. — Frustle rectangular, with straight margins. Median lines straight. Central nodule small, not transversely dilated. Connecting membrane without longitudinal lines. Striæ very coarse and distant, 6 in 0,01 mm., parallel, with very fine transverse striation. Length 0,06 mm. Breadth 0,02 mm. — Pl. 35, fig. 1 a Fr. V. fig. b. S. V.

This species, which has the outline of *A. Donkinii* Rab = *A. lineata* Donk. is remarkable for its very coarse striæ. Mr. Grunow informs me that he has seen the same species in a gathering from the Adriatic Sea.

Stauroneis australis Grev. (Ed. N. Phil. J. Vol. XVIII, pag. 187, fig. 13, 1863 H. *Stauroneis biformis* Grun. Verh. 1863, pag. 154, Pl. XIII, fig. 7). This most interesting form, described the same year by Grunow and Greville, does not seem to belong to the genus *Stauroneis*, but to a new genus, nearly related to *Mastogloia* and distinct from the latter genus by having short marginal costæ instead of the loculi. This form occurs sparsely in the Labuan material. I have also seen it in a gathering from Port Jackson. Mr. Grunow mentions it as an inhabitant of the Red Sea. The Labuan specimens have 14—15 finely punctate striæ in 0,01 mm. Length 0,086 mm. Breadth 0,035 mm.

St. bistriata Leuduger Fortm. (Diat. de Ceylon pag. 37, Pl. IX, fig. 89). I have seen only a single valve of this species, which seems to belong to the genus *Achnanthes*. The striæ, 10 in 0,01 mm., are costate and less divergent than in the figure of Mr. Leuduger. Length 0,057 mm. Breadth 0,009 mm.

Mastogloia acuta Grun. in litt. — Lanceolate, with produced ends. Rows of loculi at a little distance from the margin; loculi larger in the middle than near the ends. Striæ parallel, very fine (not counted) punctate, puncta forming longitudinal lines. Length 0,04 mm. Breadth 0,015 mm. — Pl. 35, fig. 8.

Mr. Grunow sent me some years ago a sketch of a new *Mastogloia*, called *acuta*, which resembles this form so much that I suppose they are identical. The *M. acuta* Grun. has the loculi more separate from the margins than the Labuan-specimens and the fine striæ (30 in 0,01 mm.) more radiant.

M. laminaris (Ehrb.) Grun. — Lanceolate, with produced ends. Loculi large, $4\frac{1}{2}$ in 0,01 mm. marginal. Striæ fine, 20—24 in 0,01 mm., not interrupted, reaching the median line. Length 0,03 mm. Breadth 0,01 mm.

The determination is made by the aid of a sketch kindly sent me by Mr. Grunow, who supposes, with some doubts, that it may be the *Ceratoneis laminaris* Ehrb. It has been distributed in Cl. & Möll. Diat. No 153 (Corsica). I have found the same species in gatherings from the Adriatic Sea.

M. undulata Grun. (Verh. 1860, pag. 576, Pl. I, fig. 5. T. M. S. 1877, pag. 176, Pl. CXCV, fig. 5).

M. rhombica Cl. N. Sp. — Rhombic. Med. line slightly undulate, without accompanying lines. Striæ coarse 11 in 0,01 mm. slightly radiant, composed of distinct pearl-like puncta, which form wavy longitudinal rows. Loculi marginal, equal in size, about 6 in 0,01 mm. Surface of the valve not perfectly plane, being a little impressed on both sides of the median line. Length 0,048 mm. Breadth 0,02 mm. — Pl. 35, fig. 9.

M. lanceolata Thw. (Van Heurck Syn. Pl. IV, fig. 15—17). Length of the valve 0,048 mm. Breadth 0,015 mm. Striæ 16—19 in 0,01 mm. Loculi 6 in 0,01 mm.

M. apiculata W. Sm. (Syn. II, pag. 65, Pl. LXII, fig. 387).

M. minuta Grev. — var. with 16 striæ and 8 loculi in 0,01 mm. Length 0,03—0,04 mm. Breadth 0,014 mm. — According to Grunow (T. M. S. 1877, pag. 176) *M. minuta* has closer striæ, 25 in 0,01 mm.

M. Jelineckii Grun. (T. M. S. 1877, pag. 174, Pl. CXCV, fig. 1) var. Length 0,06 mm. Breadth 0,015 mm. Striæ 18 in 0,01 mm. Loculi 5 in 0,01 mm.

M. quinque-costata Grun. (Verh. 1860, pag. 578, Pl. VII, fig. 8) Several varieties. On a small specimen, 0,03 mm. in length and 0,018 mm. in breadth, I counted 26 striæ and 4 loculi in

0,01 mm. Specimens from the Balearic Islets and from the Cape of Good Hope have 16 striæ in 0,01 mm.

M. (acutiuscula Grun. Mpt. var.?) *Labuensis* Cl. — Valve elongate, with almost parallel margins and subcuneate ends. Median line straight with approximate accompanying lines. Striæ 16—17 in 0,01 mm. parallel or a little radiant near the ends, composed of puncta, forming longitudinal striæ. Loculi of equal size, 7—8 in 0,01 mm. — Length 0,064 mm. Breadth 0,016 mm. — Pl. 35, fig. 5.

Mr. Grunow has kindly sent me a sketch of his not yet published *M. acutiuscula* from the Seychells, which differs by regular elliptic outline and has 16—21 striæ in 0,01 mm.

M. (baltica Grun. var.?) *Citrus* Cl. — Broadly oval, with apiculate ends. Striæ 18—19 in 0,01 mm., more close near the ends, about 23 in 0,01 mm., composed of puncta, which form longitudinal lines, at a right angle to the striæ. Loculi marginal of equal size 8—10 in 0,01 mm. Median line straight, with very approximate accompanying lines or furrows. Length 0,035 — 0,04 mm., breadth 0,02—0,024 mm. — Pl. 35, fig. 7.

This well defined form has very little resemblance to *M. baltica* Grun. in Van Heurck Syn. Pl. IV, fig. 24, but Mr. Grunow thinks nevertheless that it may be a variety of the latter species. According to Grunow, it comes very near to *Phlyctænia minuta* Kütz. I have seen the same form in samples from Honolulu.

M. Kjellmanii Cl. N. Sp. — Elongate, with apiculate ends, loculi marginal of almost equal size, 4 in 0,01 mm. Striæ fine, 22 in 0,01 mm., parallel, or a little radiant in the middle, punctate, puncta forming oblique lines. Median line straight. Central nodule elongated. Length 0,06 mm. Breadth 0,014 mm. — Pl. 35, fig. 6.

Rhoikoneis genuflexa Grun. (Verh. 1863 pap. 147) Striæ on the convexe valve 23 on the concave 20 in 0,01 mm.

Navicula rectangulata Greg. (Donk. Brit. Diat. Pl. X, fig. 5. Cl. & M. Diat. No 301).

N. Pandura Ehb. (A. Schm. Atl. Pl. XI, fig. 1).

N. diplosticta Grun. (A. Schm. Atl. Pl. XIII, fig. 29).

N. multicostata Grun. (A. Schm. Atl. Pl. XI, fig. 18).

N. Apis Donk. (A. Schm. Atl. Pl. XII, fig. 23 and Pl. LXIX, fig. 43).

N. futilis A. Schm. var.? (Atl. Pl. XIII, fig. 18).

N. lacrimans A. Schm. (Atl. Pl. XII, fig. 61).

N. Lyra Ehb.

- N. abrupta* Greg. var.
N. bullata Norm. (T. M. S. I, pag. 8, Pl. II, fig. 6).
N. clavata Greg. (T. M. S. IV, pag. 46, Pl. V, fig. 17).
N. exul A. Schm. (Atl. Pl. II, fig. 13).
N. Græffii Grun. (A. Schm. Atl. Pl. VII, fig. 5—6).
N. Smithii Bréb. (A. Schm. Atl. Pl. VII, fig. 14—18).
N. nitescens Greg. (A. Schm. Atl. Pl. VII, fig. 38).
N. suborbicularis Greg. (A. Schm. Atl. Pl. VIII, fig. 1, 2, 5).
N. Campylodiscus Grun. (A. Schm. Atl. Pl. VIII, fig. 9).
N. notabilis Grev. (A. Schm. Atl. Pl. VIII, fig. 46).
N. latissima Greg. (T. M. S. IV, pag. 40, Pl. V, fig. 4. A. Schm. Atl. Pl. VI, fig. 7).
 var. *kamorthensis* Grun. (A. Schm. Atl. Pl. VI, fig. 8).
N. humerosa Bréb. (A. Schm. Atl. Pl. VI, fig. 4).
N. caribæa Cl. (A. Schm. Atl. Pl. VI, fig. 10—12).
N. brasiliensis Grun. (A. Schm. Atl. Pl. VI, fig. 21 and 32).
N. sublyrata Grun. — Valve constricted in the middle, covered with parallel or sub-parallel striæ, composed of distinct puncta, 12 in 0,01 mm., reaching to the median line. Length 0,046 mm. Br. 0,01 mm. at the constriction 0,007 mm. — Pl. 35, fig. 17.
- Mr. Grunow has sent me a sketch of his *N. sublyrata*, which lives in brackish water in North America. The American species is not so strongly constricted in the middle as my specimen from Labuan. *N. Ceylanensis* Leud. Fortm. (Diat. Ceyl. Pl. II, fig. 25) seems to be nearly related to this species.
- N. scopulorum* Bréb. (Donk. B. D. Pl. XII, fig. 5).
N. O'Mearii Grun. Mpt. — Elongate, with more or less rounded ends; median line straight, terminal nodules in the ends, central nodule small. Striæ transverse and longitudinal covering the whole valve. Transverse striæ almost parallel, or very little radiant, 16 to 17 in 0,01 mm., longitudinal 18—21 in 0,01 mm.
- forma typica* Grun. Mpt. — Length 0,066 mm. Breadth 0,009 mm. Transv. str. 17, longit. 20 in 0,01 mm. Outline lanceolate, equally tapering from the middle to the somewhat acute ends. — Seychells, Grun.
- var. *labuensis* Cl. Length 0,072 mm. Breadth 0,015 mm. Transv. striæ 17 in 0,01 mm. longitudin. striæ 21 in 0,01 mm. Outline elliptic with rounded ends. — Labuan, rare.
- var. *minor* Cl. Length 0,05 mm. Breadth 0,011 mm. Trans-

verse striæ 16, slightly radiant, longitudinal 18 in 0,01 mm. — Port Jackson, rare.

This species comes near to *Navicula Vegæ* Cl. (= *Pleurosigma Kjellmanii* Cl. Arct. Diat. Pl. IV, fig. 80).

N. cancellata var. *impressa* Ldt. (Bih. t. K. Sv. Vet. Ak. Handl. 3 No 15, fig. 3).

N. Zostereti Grun. (A. Schm. Atl. Pl. XLVII, fig. 44).

The specimens from Labuan resemble exactly the figure quoted. The striæ are very finely transversely lineate as in all species of the *directa*-group.

N. Bruchii Grun. (K. Sv. Vet. Ak. Handl. 18, No 5, pag. 13, Pl. III, fig. 35). This species, classed among the *quadrin-seriatæ*-group, is beyond doubt very nearly related to *N. directa*, and has transversely lineate striæ.

N. velata A. Schm. (Atl. Pl. XLVIII, fig. 33—34).

N. aspera Ehb. (A. Schm. Atl. Pl. XLVIII, fig. 2—5).

N. liber W. Sm. (A. Schm. Atl. Pl. L, fig. 16—18).

N. maxima Greg. (T. M. S. IV, pag. 39, Pl. V, fig. 2). In the Labuan material were found both the typical form (A. S. Northsea Diat. Pl. II, fig. 44) and a variety with finer striæ 25 in 0,01 mm. Length 0,065. Breadth 0,015 mm.

N. samoensis Grun. (A. Schm. Atl. Pl. L, fig. 43—44). Striæ 10—13 in 0,01 mm. Length 0,054 mm. to 0,085 mm. Breadth 0,015—0,018 mm.

N. blanda A. Schm. (N. Sea Diat. Pl. II, fig. 27).

N. triundulata Grun. (T. M. S. 1877, pag. 178, Pl. CXCIV, fig. 10).

N. quadrisulcata Grun. (Novara Exp. Alg. pag. 101, Pl. I, fig. 14).

Pleurosigma formosum W. Sm. (Van Heurck Syn. Pl. XIX, fig. 4).

P. decorum W. Sm. (Van Heurck Syn. Pl. XIX, fig. 1).

Pl. angulatum W. Sm. — Oblique and transverse striæ 20—21.

Pl. strigosum W. Sm. (Van Heurck Syn. Pl. XIX, fig. 2).

P. rigidum W. Sm. (Van Heurck Syn. Pl. XIX, fig. 3).

P. australe Grun. (Novara pag. 21, Pl. I, fig. 18).

P. marinum Donk. (T. M. S. VI, pag. 22, Pl. III, fig. 3). Transverse striæ 20 oblique 19 in 0,01 mm.

Donkinia carinata Donk. (Pleur. car. Donk. T. M. S. VI, pag. 23, Pl. III, fig. 5). Length of the valve 0,065 mm.; breadth 0,014 mm. Transverse striæ 22, oblique 21—22 in 0,01 mm.

D. recta Donk. (Pleur. r. D. l. c. fig. 6). Length 0,093; breadth 0,012 mm. Longitudinal striæ 20, transverse striæ 21 in 0,01 mm.

Amphiprora delicatula Grev. (Edinb. N. Phil. J. XVIII, pag. 39, fig. 15—16). Length 0,075 mm. Breadth 0,015 mm. Striæ 26 in 0,01 mm.

Achnanthes javanica Grun. (Arct. Diat. pag. 18).

A. seriata Grun. (Arct. Diat. pag. 19).

Orthoneis fimbriata (Btw.) Grun. (Van Heurck Syn. Pl. XXVIII, fig. 3).

O. Clevei Grun. (l. c. f. 4).

O. binotata Grun. (l. c. fig. 7).

Cocconeis Scutellum Ehb. (Van Heurck Syn. Pl. XXIX, fig. 1—12).

C. heteroidea Hantzsch (Ost Ind. Arch. Diat. pag. 21, fig. 10).

C. pseudomarginata Greg. (Van Heurck Syn. Pl. XXIX, fig. 20—21).

C. dirupta var. *flexella* Grun. (Van Heurck Syn. Pl. XXIX, fig. 16).

Epithemia Musculus Kütz. (W. Sm. Syn. I, pag. 14, Pl. I, fig. 10).

Plagiogramma (caribæum var.?) *Labuense* Cl. N. Sp. — Valve constricted in the middle, where there is a large annulus. Transverse septa in the ends not distinct. Median raphe distinct. Striæ, composed of separate puncta, 11 in 0,01 mm. Length 0,05 mm. Breadth 0,011 mm., at the constriction 0,007 mm. — Pl. 37, fig. 62.

P. Seychellarum Grun. in litt. — Valve elliptic with rounded ends. Centre with a large annulus, ends without costæ. Striæ fine, transverse, absent in the middle and at the ends, 18 in 0,01 mm., composed of fine puncta forming oblique lines (16 in 0,01 mm.). There is a distinct median raphe. Length 0,075. Breadth 0,013 mm. — Pl. 37, fig. 59 a, b.

P. interruptum var. *adriatica* Grun. (Van Heurck Syn. Pl. XXXVI, fig. 1)? Transverse striæ 26 in 0,01 mm. composed of puncta forming longitudinal striæ, 26 in 0,01 mm. Median raphe distinct. Length 0,056 mm. Breadth 0,008 mm. — Pl. 37, fig. 61 a, b.

P. decussatum Grev. (T. M. S. XIV, pag. 1, Pl. I, fig. 22).

P. obesum Grev. (M. J. VII, pag. 211, Pl. X, fig. 12—13).

P. tenuistriatum Cl. N. Sp. — Elliptic with rounded ends. Central annulus large; no costæ at the ends. Striæ transverse, 18 in 0,01 mm., composed of distinct puncta, which also form longitudinal lines. Length 0,032. Breadth 0,01 mm. — Pl. 37, fig. 63.

P. pygmæum Grev. (M. J. VII, pag. 211, fig. 11).

P. orientale Grev. (T. M. S. XIV, pag. 77, Pl. VIII, fig. 1).

P. tessellatum Grev. (M. J. Vol. VII, pag. 208, Pl. X, fig. 7).

P. pulchellum Grev. (M. J. VII, pag. 209, fig. 4—6).

P. costatum Grev. (Ed. N. Phil. Journ. XVIII, 1863, pag. 35, fig. 5—6). The structure of the valve consists of numerous, strong, transverse costæ and fine striæ, composed of puncta, 2 to 3 between each pair of costæ.

Dimerogramma minus Greg. (Diat. of Cl. pag. 495, Pl. X, fig. 35).

var. *nana* (Greg.).

Raphoneis amphicerus Ehr. — In the Labuan material I have seen this species in an almost incredible number of varieties, of which some are described as distinct species,

a. *forma typica* Pl. 37, fig. 52 a. Van Heurck Syn. Pl. XXXVI, fig. 20—23.

b. var. *major* *Raphoneis lanceolata* Ehb.? Length 0,075 mm. Breadth 0,023 mm. Rows of puncta 7 in 0,01 mm.

c. var. *triangularis*.

d. var. *cruciata* = *Amphitetras cruciata* Jan & Rab. Hond. Diat. pag. 4, Pl. I, fig. 5. — Intermediate forms between a. and d. are common in the Labuan material. Pl. 37, fig. 52 b. Such an intermediate variety is *Raph. amph. var. californica* Grun. in Van Heurck Syn. XXXVI, fig. 24.

e. var. *pentagona*. Pl. 37, fig. 52. c intermediate between d. and e.

f. var. *Castracanei* Grun. (Van Heurck Syn. Pl. XXXVI, fig. 28) Labuan.

R.? *bilineata* Gr. & Cl. — Valve variable in the outline, generally lanceolate. Sculpture strong, parallel costæ 7 in 0,01 mm., which, according to Grunow, are delicately punctate. The costæ are interrupted by strongly marked lines on both sides of the raphe. Length 0,025—0,054 mm. Breadth 0,008—0,012 mm.

forma a. *lancettula* Gr. & Cl. valve lanceolate — Pl. 37, fig. 55, b. Labuan, Seychelles (Grun.).

forma b. *protracta* Cl. valve with protracted ends, median raphe expanded to an area. Length 0,048. Br. 0,012 mm. — Pl. 37, fig. 55 a. — Labuan, Seychells (Grun.).

forma c. *elliptica* Grun. Valve elliptic — Seychells (Grun.)

forma d. *contracta* Grun. Valve contracted in the middle. Seychells (Grun.).

R. maculata Cl. N. Sp. — Rhombic or lanceolate, covered with pearl-like puncta, arranged in rows, crossing each other

at right angles, about 10 in 0,01 mm. In the centre of the valve is a large blank area, where the puncta are absent or as erased. Length 0,03—0,05 mm. Breadth 0,012—0,014 mm. — Pl. 37, fig. 56.

R. quarnerensis Grun. (Verh. 1862, Pl. IV, fig. 24)? It is with great hesitation I have determined the form Pl. 37, fig. 53 as the above species. There is in the middle of the area a faint trace of a median line and of a very indistinct central nodule, from which characters the form may approach the genus *Glyphodesmus*. The forme of the valve is sometimes a little cuneate (a).

R.? marginulata Cl. & Grun. — Lanceolate with marginal striæ, 15 in 0,01 mm., surrounding an apparently structure-less large area. Length 0,042 mm. Breadth 0,009 mm. — Pl. 37, fig. 57.

Mr. Grunow found the same species in gatherings from the Seychells. According to Mr. Grunow the large area is pervaded by the shallow continuation of the marginal striæ and has in the middle a median line, which I could not see with my lenses.

Trachysphenia australis H. L. Smith. (*Raphoneis australis* H. L. Sm. Am. Quarterl. M. J. 1878, pag. 14, Pl. III, fig. 6. *Tr. australis* var.? *Aucklandica* Grun. in Van Heurck Syn. Pl. XXXVII, fig. 1). The genus *Trachysphenia* was established by Mr. Petit in 1877 (*Diat. de Campbell* pag. 32). The *Tr. australis* Petit l. c. Pl. V, fig 19, is large and has 6 puncta in 0,01 mm. It seems then to be different from *Raphoneis australis* H. L. Smith, which is 0,0128—0,0218 mm. in length and has 12 puncta in 0,01 mm. The specimens from Labuan are about 0,022 mm. in length and have 11 rows of puncta on 0,01 mm. Similar forms have I seen in gatherings from Port Jackson. The cuneate form of the valve does not seem to be a constant characteristic, as I have found elliptic valves, to the sculpture agreeing with the cuneate ones. Such a specimen, var. *elliptica* Cl., has been figured on Pl. 37, fig. 54.

Synedra commutata var. *septentrionalis* Grun. (Van Heurck Syn. Pl. XL, fig. 5) Length 0,054 mm. Striæ 13 in 0,01 mm.

S. affinis Kütz. — Striæ 13 in 0,01 mm., area tolerably narrow.

S. Henedyana Greg. (*Diat. of Clyde* pag. 532, Pl. XIV, fig. 108).

S. crystallina var. *Smithii* Grun. (Van Heurck Syn. Pl. XLII, fig. 10).

S. fulgens Grev. (Sm. Syn. 1, pag. 74, Pl. XII, fig. 103).

S. formosa Hantzsch (Ost. Ind. Arch. Diat. pag. 19, Pl. V, fig. 3).

Fragilaria? pacifica Grun. (Van Heurck Syn. Pl. XLIV, fig. 21—22).

Fr.? Schwarzii Grun. (Van Heurck. l. c. fig. 24).

Licmophora Lyngbyei (Kütz) Grun. (Van Heurck Syn. Pl. XLVII, fig. 16) Length of the valve 0,065, breadth 0,008 mm. Striæ at the base 12, in the summit 15 in 0,01 mm.

Grammatophora oceanica Ehb. Several varieties were found in the Labuan material, among them the var. *intermedia* Grun. (Van Heurck Syn. Pl. LIII, fig. 15) with 26 striæ in 0,01 mm.

Gr. maxima var. *Trinitatis* Grun. (Bot. Centr. Bl. 1881, Bd VII, Beil. pag. 8) Length 0,075, breadth 0,008 mm. Striæ 30 in 0,01 mm.

G. undulata var. *gibba* Grun. (Van Heurck Syn. XIII B, fig. 17).

Striatella interrupta Ehb. (Van Heurck Syn. Pl. LIV, fig. 8).

Rhabdonema adriaticum Kütz.

Climacosphenia elongata Bail (Smith's Contr. VII, fig. 10—11) Striæ 21 in 0,01 mm.

Hantzschia amphioxys var. *borneensis* Cl. Length 0,1 mm. Striæ 9 in 0,01 mm., composed of distinct puncta; carinal puncta 3 in 0,01 mm.

H. virgata Roper. (Van Heurck Syn. Pl. LVI, fig. 12).

Nitzschia (punctata var.?) diluviana Cl. (Schr. der phys. Oek. Ges. zu Königsb. Bd XXII, pag. 139) Lanceolate (of the same outline as *Nitz. lanceola* Grun.) one half of the valve not on the same plane as the other. Striæ, composed of distinct and separate puncta, 11 in 0,01 mm. carinal puncta indistinct. Length 0,035 mm. Breadth 0,008 mm. Pl. III, fig. 67.

I found this form first in diluvial clay from East Prussia.

N. panduriformis Greg. (Grun. Arct. Diat. pag. 71). Length 0,075 mm. Breadth 0,02 mm. Striæ 17 in 0,01 mm.

N. Jelineckii Grun. (Arct. Diat. pag. 74).

N. marginulata Grun. (Arct. Diat. pag. 72). Puncta 10—13 in 0,01 mm. Striæ 20—25 in 0,01 mm. Length 0,066 mm. Breadth 0,016 mm. Sides of the valve almost parallel.

N. (vivax var.?) fluminensis Grun. (Arct. Diat. pag. 86. Van Heurck Syn. Pl. LXII, fig. 3).

N. (sigma var.?) valida Cl. & Grun. (Van Heurck Syn. Pl. LXV, fig. 5).

N. labuensis Cl. N. Sp. — Valve elongate; keel eccentric with large and distant puncta, 4—5 in 0,01 mm., of which the

central is much larger than the others. Striæ extremely fine, about 36 in 0,01 mm. (sec Grunow) marginal. Length 0,083 mm. Breadth 0,006 mm. Very rare in the Labuan material. — Pl. 37, fig. 66.

N. Sigma var. *intercedens* Grun. (Casp. Sea. Alg. pag. 22). Puncta 7, striæ 30 in 0,01 mm.

N. obtusa W. Sm. Very long and slender form with 10 puncta and 27 striæ in 0,01 mm.

N. (Homoeocladia) Vidovichi Grun. (Van Heurck Syn. Pl. LXVII, fig. 7)

N. vitrea Norm. (Grun. Arct. Diat. pag. 93). Puncta 7, striæ 24 in 0,01 mm. Length 0,1 mm. Breadth 0,008 mm.

N. lanceolata W. Sm. var. with 10 puncta and 26 striæ in 0,01 mm. Length 0,08 mm. Breadth 0,01 mm.

N. longissima (Bréb.) Ralfs. (Van Heurck Syn. Pl. LXX, fig. 1—2).

N. ventricosa Kitton (M. M. Jour. Nov. 1873, pag. 206, Pl. XXXVIII, fig. 5).

Surirella fastuosa Ehb. (A. Schm. Atl. Pl. V, fig. 10—13).

S. cuneata O. Witt (A. Schm. Atl. Pl. IV, fig. 1).

Campylodiscus ambiguus Grev. (A. Schm. Atl. Pl. XVIII, fig. 23).

C. undulatus Grev. (A. Schm. Atl. Pl. XVIII, fig. 11).

var. *biangulatus* Grev. (A. Schm. Atl. Pl. XIV, fig. 18).

C. Thuretii Bréb. a very small variety.

C. parvulus (W. Sm.?) Van Heurck (Syn. Pl. LXXVII, fig. 2).

C. Ralfsii Sm. (A. Schm. Atl. Pl. XIV, fig. 3).

Campylodiscus(?) cocconeiformis Grun (Cl. & Möll. Diat. No 178 and 214). Length 0,02—0,036 mm. Breadth 0,018—0,028 mm. — Pl. 38, fig. 78.

Plagiodiscus nervatus Grun. (M. J. 1877, pag. 172, Pl. CXCIV, fig. 9).

Bacteriastrum varians Laud. (Van Heurck Syn. Pl. LXXX, fig. 3—5).

Chaetoceros diversus Cl. (Van Heurck Syn. Pl. LXXXI, fig. 5).

Ch. peruvianus Btw. (M. J. IV, pag. 107, Pl. VII, fig. 16—18).

Podosira hormoides Mont. (Van Heurck Syn. Pl. LXXXIV, fig. 3).

Melosira sulcata Ehb.

Melosira labuensis Cl. N. Sp. — Valve as high as broad, rounded at the end, covered by puncta arranged in straight lines, radiating from the apex to the suture, 18 in 0,01 mm. Height of valve 0,008 mm. Breadth 0,012 mm. — Pl. 38, fig. 84.

Cyclotella striata Kütz var. *stylorum* Btw. (Van Heurck Syn. Pl. XCII, fig. 2—5).

Coscinodiscus (*Hauckii* Grun. var.?) *mesoleius* Cl. — Very thin and transparent. Striæ marginal, composed of fine puncta, 28 in 0,01 mm., surrounding a large structure-less centre. Diam. 0,03 mm. — Pl. 38, fig. 82.

This form differs from *Cos. Hauckii* Grun. (Van Heurck Syn. Pl. XCIV, fig. 29) by its structure-less central area, which in the Grunowian species is covered with large scattered puncta.

C. excentricus Ehb. (A. Schm. Atl. Pl. LVIII, fig. 46, 47, 48).

C. nitidulus Grun. (A. Schm. l. c. fig. 20).

C. lineatus Ehb. (A. Schm. Atl. Pl. LIX, fig. 29—30).

C. radiatus Ehb. (A. Schm. Atl. Pl. LX).

Biddulphia reticulata Roper var. A. Schm. Atl. Pl. LXXVIII. fig. 21.

var.? *dubia* (Btw.) — *Triceratium* dub. Btw. M. J. VII, pag. 180, Pl. IX, fig. 12 *T. bicornis* Cl.

B. Roperiana Grev. (Van Heurck. Syn. Pl. XCIX, fig. 6).

Triceratium punctatum Btw. (Pritch. Inf. Pl. VI, fig. 20).

T. parvulum Jan. & Rab. (Hond. pag. 4, Pl. I, fig. 4, *Amphitetras*).

T. Favus Ehb. a small form.

Eunotogramma lævis Grun. (Cl. & Möll. Diat. No 257 —? Leudug. Fortm. Diat. Ceyl. Pl. IX, fig. 93, 94, 95, *Biddulphia lunaris* Ehb.?)

Anaulus minutus Grun. (Van Heurck Pl. CIII, fig. 4—5).

Cerataulus labuensis Cl. N. Sp. — Hyaline; valve broadly ovale with rounded ends. Surface covered with extremely fine striæ, 28 in 0,01 mm., almost parallel, near the ends radiating, passing from the longitudinal axis of the valve to the margin. Both valves of the frustle at an angle to each other. F. W. trapeziform or irregularly quadratic; in the corners of the valves are ocelli visible. Connecting membrane ∞ shaped. Length of the valve 0,025—0,04 mm. — Pl. 38, fig. 80.

Both valves are not opposite to each other, for which reason the connecting membrane forms a somewhat twisted tubus.

Auliscus cælatus Bail (A. S. Atl. Pl. XXXII, fig. 13).

A. Stöckhardtii Jan. (Guan. Pl. I, fig. 4).

Aulacodiscus margaritaceus Ralfs (A. Schm. Atl. Pl. XXXVII, fig. 7).

Actinoptychus hexagonus Grun. (A. Schm. Atl. Pl. I, fig. 15).

A. splendens Shadb. (*Halionyx undenarius* Jan. Guan. Pl. I, fig. 1).

Actinocyclus Ehrenbergii Ralfs (Pritch. Inf. pag. 834) large and fine specimens.

Asteromphalus flabellatus Bréb. (A. Schm. Atl. Pl. XXXVIII, fig. 10—12).

A. impar Shadb. (T. M. S. 154, pag. 17, Pl. I, fig. 17).

V. Diatoms from Ceylon.

During the stay of the Vega at Point de Galle Dr. Kjellman made some collections of marine algæ. On cleaning them he collected the washing a water deposits, which were given to me for examination. Also some samples of marine coarse mud were taken and sent to me. The latter were very poor in diatoms, but the first named deposit tolerably rich. On the marine diatoms of Ceylon we have by Dr. Leuduger-Fortmorel an elaborate paper, containing descriptions of many new forms¹. The samples collected by Dr. Kjellman contained scarcely any of the species described by Dr. Leuduger-Fortmorel, but a lot of forms not recorded in the named paper. The collection of Dr. Kjellman completes in a welcome manner the number of marine species, known from Ceylon. I think it will be most convenient to enumerate the forms, contained in the samples from the Vega-Expedition, in the same order as in the paper of Dr. Leuduger-Fortmorel. I have added a * to each species not found by Dr. Leuduger-Fortmorel.

Cocconeis Scutellum Ehb. (Van Heurck Syn. Pl. XXIX, fig. 1—12).

* *C. heteroidea* Hantzsch (Ost. Ind. Arch. pag. 21, fig. 10).

* *C. pseudomarginata* Greg. (D. of Cl. pag. 492, Pl. IX, fig. 29, *C. major* l. c. pag. 28).

* *C. pellucida* Grun. (Hantzsch Ost. Arch. D. pag. 21, fig. 11).

* *Orthoneis fimbriata* (Btw.) Grun. (*Mastogloia cribrosa* Grun. p. p. Trans. M. S. VII, pag. 179, Pl. IX, fig. 3).

* *Campyloneis Grevillei* (W. Sm.) Grun. V. H. Syn. Pl. XXVIII, fig. 10—12).

* *Achnanthes javanica* Grun. (A. D. pag. 18).

* *A. bengalensis* Grun. (l. c.).

A. pennata Grev. — One single valve of an *Achnanthes*, which I believe belongs to *A. pennata*, was found in the Ceylon-material, but having had no occasion to see the fig.

¹ Catalogue des Diatomées de l'île de Ceylan. Mémoires de la Société d'Émulation des Côtes du Nord. 1879.

published by Greville I cannot be sure of the identity. The valve was 0,072 mm. in length and 0,005 mm. in breadth. Striæ 13 $\frac{1}{2}$ in 0,01 mm. — Pl. 35, fig. 2.

Amphora ostrearia Bréb. (A. S. Atl. Pl. XXVI, fig. 23).

A. crassa Greg. (A. S. Atl. Pl. XXXIX, fig. 30).

* *A. cymbelloides* Grun. (Hedw. 1867, VI p. 24, Cl. & M. D. No 147).

* *Navicula Apis* Donk. (A. S. Atl. XII, fig. 23).

* *N. Advena* A. S. Atl. (Pl. VIII, fig. 29).

N. aspera Ehb. (A. S. Atl. XLII, fig. 26).

N. brasiliensis Grun. var.? — L. 0,065. Br. 0,03 mm. Str. 14 in 0,01 mm.

* *N. consors* A. S. (Atl. Pl. XLVIII, fig. 24—27).

N. circumsecta Grun. (A. S. Atl. Pl. III, fig. 27).

N. directa Sm. var.? (A. S. Atl. Pl. XLVII, fig. 12 and 1. c. fig. 13.)

* *N. Leudugeri* Cl. N. S. — Elliptic; med. line straight. Striæ radiant, coarse, 8 in 0,01 mm., composed of 3 to 4 large elongate and transversely lineate puncta, reaching to the med. line, except in the middle, where they are shortened. L. 0,07 mm. B. 0,016 mm. This species resembles *N. guttata* Grun. (A. S. Atl. Pl. XLVI, fig. 10) but is not so convex and has different end-pores. — Pl. 36, fig. 22.

N. futilis A. S. (Atl. Pl. XIII, fig. 17, 19).

* *N. formosa* Greg. (A. S. Atl. Pl. L, fig. 9—10). Str. 15 in 0,01 mm. L. 0,085 mm. Br. 0,018 mm.

* *N. fluminensis* Grun. (A. D. p. 28). L. 0,07 mm. Br. 0,01 mm. Str. 15 in 0,01 mm.

N. gemmatula Grun. (A. S. Atl. Pl. XIII, fig. 21).

N. Henedyi W. Sm. (A. S. Atl. Pl. III, fig. 17—18).

N. indica Grev. (T. M. S. II, pag. 95, Pl. IX fig. 13).

N. lacrimans A. S. Atl. (Pl. XII, fig. 61).

N. Lyra Ehb. var.

N. Musca Greg. (A. S. N. D. Pl. I, fig. 15).

N. maxima Greg. var. — A very large form with somewhat inflated middle and subcuneate ends. Length 0,16, breadth 0,017 mm. Striæ 20 in 0,01 mm. at the ends and in the middle.

N. multicostata Grun. (A. S. Atl. Pl. XI, fig. 14—20).

N. nitescens Greg. (A. S. Atl. Pl. VII, fig. 37—41).

N. notabilis Grev. (A. S. Atl. Pl. VIII, fig. 46).

* *N. nicobarica* Grun. — Only one specimen, perfectly agreeing with a figure sent by Mr. Grunow but not with the fig. given in A. Schm. Atl. Pl. VIII, fig. 57 and LXX, fig. 35, 36. The

striae are costate and smooth, not punctate as in the fig. of A. S. Atl. — Pl. 35, fig. 16.

N. Pandura Ehb. (A. S. Atl. Pl. XI, fig. 1).

* *N. pygmæa* Kütz (A. S. N. S. D. Pl. I, fig. 43).

N. prætexta Ehb. (A. S. Atl. Pl. III, fig. 32).

* *N. quadrisulcata* Grun. (Nov. pag. 101, Pl. I, fig. 14).

* *N. rhombica* Greg. (T. M. S. IV, pag. 38, Pl. V, fig. 1).
L. 0,07. Br. 0,02. Str. 17 in 0,01 mm.

N. splendida Greg. (T. M. S. IV, pag. 44, fig. 14).

N. Smithii Bréb. (A. S. Atl. Pl. VII, fig. 14—18).

* *N. separabilis* A. S. (Atl. Pl. XI, fig. 3).

N. Weissflogii A. S. (Atl. Pl. XII, fig. 26—31).

* *N. velata* A. S. (Atl. Pl. XLVIII, fig. 33—34).

* *N. Yarrensii* Grun. (A. S. Atl. Pl. XLVI, fig. 3).

* *N. sp.* A. S. Atl. Pl. XLVII, fig. 12 et 13.

* *Rhoikoneis genuflexa* (Kütz?) Grun. (Verh. 1863, pag. 147).
Striae on the convex valve 18, on the concave 17 in 0,01 mm.

* *Pleurosigma decorum* W. Sm. (Van Heurck Syn. Pl. XIX, fig. 1).

* *P. giganteum* Grun. (Verh. 1860, Pl. VI, fig. 1).

P. australe Grun. (Nov. p. 21, Pl. I, fig. 18).

* *P. strigosum* W. Sm. Length 0,11 mm. Br. 0,02 mm.
Trans. and obl. str. 20 in 0,01 mm.

* *Rhoicosigma robustum* Grun. (A. D. p. 58) Length 0,4.
Br. 0,06 mm. Long. striae 13 1/2, trans. 11 1/2 in 0,01 mm.

* *R. antillarum* Cl. (West. Ind. D. pag. 9, Pl. II, fig. 14).
Longit. striae 24, transverse 18 in 0,01 mm.

* *Amphiprora lepidoptera* Greg. (Van Heurck Syn. Pl. XXII, fig. 2).

* *A. balearica* Cl. & Grun. (A. D. p. 63).

Nitzschia panduriformis Greg. (Van Heurck Syn. Pl. LVIII, fig. 1).

var. *continua* Grun. (l. c. fig. 6).

N. pand. v. lata (O. W.) Grun, A. D. pag. 71.

N. Jelinecki Grun. (A. D. pag. 74).

* *N. granulata* Grun. (M. J. III, Pl. XII, fig. 7, 1880).

N. Sigma W. Sm. (Van Heurck Syn. Pl. LXV, fig. 7—8).

* *N. cursoria* (Donk.) Grun. (Van Heurck Syn. Pl. LXII, fig. 19).

* *N. angularis* W. Sm. (Van Heurck Syn. l. c. fig. 11—14).

* *N. vivax* (W. Sm.) Grun. — Puncta 6—7. Str. 13 in 0,01 mm. punctate. L. 0,135 mm. Keel unusually eccentric.

* *N. affinis* Grun. (Van Heurck Syn. Pl. LXII, fig. 16).

* *N. fluminensis* Grun. (Van Heurck Syn. Pl. LXII, fig. 3 a. 4) L. 0,1 mm. Puncta 5—6. Str. $19\frac{1}{2}$ in 0,01 mm.

* *N. (Homoeocladia) Vidovichii* Grun. (Van Heurck Syn. Pl. LXVII, fig. 7).

* *N. ventricosa* Kitton. (M. J. 1873, Pl. XXXVIII, fig. 5).

N. nicobarica Grun. (M. J. III 1880, Pl. XII, fig. 2).

N. marina Grun. (Van Heurck Syn. Pl. LVII, fig. 26,27) Str. 11, oblique striæ 16 in 0,01 mm. Length 0,23. Br. 0,008 mm.

Surirella fastuosa W. Sm. (Grev. T. M. S. X, Pl. III, fig. 1, A. S. Atl. Pl. V, fig. 13, 15).

* *S. manca* Janish (A. S. Atl. LVI, fig. 9).

* *Campylodiscus Ralfsii* Sm. (A. S. Atl. Pl. XIV, fig. 1).

C. undulatus Grev. (A. S. Atl. XVIII, fig. 11, C. Grevillei Leuduger p. 47, Pl. V, fig. 54—56).

C. biangulatus Grev. (A. S. Atl. XIV, fig. 18) scarcely more than a variety of *C. undulatus*.

C. ornatus Grev.

* *C. sp.* A. S. Atl. Pl. XIV, fig. 27.

* *C. Dæmelianus* Grun. (A. S. Atl. Pl. LIV, fig. 1 a. 2).

* *C. Thuretii* Bréb. (Van Heurck Syn. Pl. LXXVII, fig. 1).

C. ambiguus Grev. (A. S. Atl. XVIII, fig. 23—26).

* *Synedra Baculus* v. *minor* Grun. (T. M. S. 1877, p. 168, Pl. CXCIV, fig. 1).

* *S. formosa* Hantzsch. var. — Str. 12 in 0,01 mm.

* *S. crystallina* var. — Med. line indistinct, lateral very strong. Striæ $10\frac{1}{2}$ in 0,01 mm.

* *S. lævigata* Grun. (T. M. S. 1877, p. 166, Pl. CXCH, fig. 3).

S. Henedyana Greg. (Van Heurck Syn. Pl. XLII, fig. 3).

S. undulata (Bail) Greg. (Van Heurck Syn. Pl. XLII, fig. 2).

Sceptroneis cuneata Grun. — var. with 16 striæ in 0,01 mm. and indiscernible longitudinal furrows.

S. intermedia C. N. Sp. — Linear with very little dissimilar ends. Length 0,3 mm. Br. 0,018 mm. Median line not visible, lateral strong. Striæ $16\frac{1}{2}$ in 0,01 mm., finely punctate. Ends with radiant lines of small puncta. — Pl. 37, fig. 60.

Raphoneis Surirella (Ehb.?) Grun. (Van Heurck Syn. Pl. XXXVI, fig. 26—27).

* *R. bilineata* Cl. & Grun. pag. 499.

R. amphiceros Ehb var. *cruciata* (Amphitetras cruciata Jan & Rabh. conf. pag. 499).

* *Dimerogramma ceylanica* Cl. N. S. — Linear with rounded ends. Striæ punctate 16 in 0,01 mm., marginal. Length 0,08. Br. 0,01 mm. — Pl. 37, fig. 58.

- Plagiogramma pulchella* Grev. (M. J. VII, p. 209, fig. 4—6).
P. decussata Grev. (T. M. S. XIV, p. 1, Pl. I, fig. 1 a. 2).
 * *Pl. attenuata* Cl. (West. Ind. Diat. pag. 10, Pl. III, fig. 18).
P. staurophora (Greg.) Heib. (Van Heurck Syn. Pl. XXXVI, fig. 2).
 * *Cyclophora tenuis* Castr. (Van Heurck Syn. Pl. XXXVI, fig. 5).
 * *Licmophora Lyngbyei* v. *Pappeana* Grun. (Van Heurck Syn. XLVII, fig. 15). Upper striæ 13 in 0,01 mm. Lower 12 in 0,01 mm. Length of valve 0,05—0,06. Br. 0,08 mm.
 * *L. flabellata* C. Ag. (Van Heurck Syn. Pl. XLVI, fig. 2).
Euphyllodium spathulatum Shadb. (M. J. II, Pl. I, fig. 3).
Climacosphenia elongata Bail.
Grammatophora hamulifera Kütz. (*G. uncina* Leuduger pag. 55, Pl. V, fig. 60?).
G. oceanica Ehb.
G. undulata Ehb. forma *genuina* Grun. (Beil. z. Bot. Centralbl. Vol. VII, fig. 11).
 * *G. maxima* Grun.
 * *Rhabdonema adriaticum* Kütz.
 * *Climacosira mirifica* (W. Sm.) Grun. (Verh. 1862, pag. 424, Pl. IX, fig. 3).
 * *Striatella delicatula* (Kütz.) Grun. (Van Heurck. Syn. Pl. LIV, fig. 2).
 * *Isthmia Lindigiana* Grun. (Micr. Journ. 1877, Pl. CXCVI, fig. 1).
Biddulphia pulchella Gray.
 var. T. M. S. X, pag. 25, Pl. III, fig. 3—4.
B. Tuomeyi Roper.
B. Edwardsii Febig (Van Heurck Syn. Pl. C, fig. 10).
 * *B. Roperiana* Grev. (T. M. S. VII, pag. 163, Pl. VIII, fig. 11—13).
B. reticulata Roper (Van Heurck Syn. Pl. CII, fig. 1—2).
 var. *trigona* Grun. (Van Heurck l. c. fig. 3).
B. dubia (Btw.) (Tric. dubium Btw. T. M. S. VII, pag. 180, Pl. IX, fig. 12. Tric. bicornis Cl. West. Ind. Diat. Pl. V, fig. 30).
B. mobiliensis Bail. (Van Heurck Syn. Pl. CI, fig. 6).
 * *B. turgida* Ehb. (*B. granulata* Roper T. M. S. Vol. VII, pag. 13, Pl. I, fig. 10—11, Van Heurck Syn. Pl. XCIX, fig. 7—8).
 * *Cerataulus Titianus* Grun. (Verh. 1863, pag. 158, Pl. XIII, fig. 25, Bidd. membranacea Cl. West. Ind. Diat. pag. 20, Pl. V, fig. 33).
 * *C. lævis* Ehb. (Roper. T. M. S. Vol. VII, Pl. II, fig. 25—26).
 * *C. turgidus* W. Sm. (Syn. II, pag. 50, Pl. LVI, fig. 323).

* *Hydrocera compressa* Wallich (M. J. Vol. VI, pag. 252, Pl. XIII, fig. 7—12). The structure of the valve consists of a coarse reticulation of large 5—7-gonal cells, 6 in 0,01 mm., and a finer decoration of small puncta arranged in lines radiating from the centre. Ends of the valve (in S. V.) destitute of the coarse reticulation.

Anaulus birostratus Grun. (Van Heurck Syn. Pl. CIII, fig. 1—2).

* *Triceratum (arcticum var.?) formosum* Btw. (A. Schm. Atl. Pl. LXXIX, fig. 2) 3—6-gonal varieties.

T. punctatum Btw. (M. J. Vol. IV, pag. 275, Pl. XVII, fig. 18).

* *T. cinnamomeum* Grev. (M. J. N. S. III, pag. 232, Pl. X, fig. 12).

T. Farus Ehb.

T. Pentacrinus Wallich (M. J. VI, pag. 249, Pl. XII, fig. 10—19).

* *T. elongatum* Grun. (A. Schm. Atl. Pl. LXXX, fig. 12).

* *T. armatum* Roper (M. J. II, pag. 283).

Hemidiscus cuneiformis Wallich (Pritch. Inf. Pl. VI, fig. 14 and probably *Euodia Ceylanensis* Leuduger pag. 62, Pl. VI, fig. 65).

* *Aulacodiscus orientalis* Grev. (T. M. S. XII, pag. 12, Pl. II, fig. 6. A. Schm. Atl. Pl. XXXIV, fig. 2).

* *B. Beeveriæ* Johns. (Pritch. Inf. pag. 844, Pl. VI, fig. 5). This form has been distributed in Cl. and Möll. Diat. No 278 as *A. Comberi* var. *ceylanica* Grun., according to the determination of Grunow. I think nevertheless that it may be the *A. Beeveriæ* of Johns.

* *A. Macræanus* Grev. (T. M. S. X, pag. 23, Pl. II, fig. 4).

Coscinodiscus radiatus Ehb. (A. S. Atl. Pl. LX, fig. 6—7).

C. excentricus Ehb. (A. S. Atl. LVIII, fig. 46).

* *C. denarius* A. S. (Atl. Pl. LVII, fig. 20—21).

* *C. cocconeiformis* A. S. (Atl. Pl. LVIII, fig. 25—28).

C. nitidus Greg. (A. S. Atl. Pl. LVIII, fig. 18).

* *C. sp.* A. S. Atl. LVII, fig. 32.

* *C. subtilis* Ehb. (A. S. Atl. Pl. LVII, fig. 14).

* *C. symmetricus* (Grev.?) A. S. (Atl. Pl. LVII, fig. 27).

* *Actinocyclus Ehrenbergii* Ralfs (Prit. Inf. p. 834).

* *A. tenellus* Bréb. (Donkin M. J. I, pag. 7; Pl. I, fig. 16. *A. moniliformis* Ralfs? A. S. N. S. D. III, fig. 31).

* *A. subtilis* Greg.

* *Actinoptychus hexagonus* Grun. (A. S. Atl. Pl. I, fig. 15).

v. *tenella* A. S. l. c. fig. 16.

A. quaternatus Ehb. (Jan. Guan Pl. I, A., fig. 8).

A. splendens (Shadb.) Ralfs (*Halionyx undenarius* Jan. Guan. Pl. I, fig. 1).

* *Asteromphalus flabellatus* Bréb. (Grev. M. J. VII, p. 160, Pl. VII, fig. 4 et 5).

Melosira sulcata Ehb.

M. (Endictya) oceanica Btw. (A. S. Atl. Pl. LXV, fig. 10, 12, 13).

* *Podosira Argus* Grun. (M. J. 1879, Pl. XXI, fig. 6). Diameter 0,08 mm. Striæ on the rim about 20 in 0,01 mm. The puncta which compose these striæ are arranged in quincunx as in many species of *Pleurosigma*.

P. maculata W. Sm. (Lagerst. Bih. t. K. Sv. Vet. Ak. Handl. III, No 15, fig. 1).

* *P. Montagnei* Kütz. (Van Heurck Syn. Pl. LXXXIV, fig. 11).

* *P. ambigua* Grun. (A. D. p. 118, M. J. 1879, Pl. XXI, fig. 7).

* *P. maxima* (Kütz.) Grun. (A. D. p. 118). Diam. 0,065 mm. Umbilic. 0,01 mm. Rows of puncta 16 in 0,01 mm. near the umbilicus, 20 near the margin.

VI. Diatoms from Bab-el-Mandeb.

Between Aden and Bab-el-Mandeb were taken samples of bottom-mud, which contained, sparsely, some diatoms, among which I have determined the following:

Amphora zebrina Jan (A. Schm. Atl. Pl. XXV, fig. 11).

A. robusta Greg. (Diat. of Cl. pag. 516, Pl. XIII, fig. 79).

A. Proteus Greg. var.

A. crassa Greg. (Diat. of Cl. pag. 525, Pl. XIV, fig. 94).

A. furcata Leuduger-Fortm. (Diat. de Ceylan pag. 20, Pl. I, fig. 11).

A. mexicana A. Schm. (Atl. Pl. XXVII, fig. 47—48).

A. cymbifera Greg. — Length of valve 0,085 mm., breadth 0,011. Striæ 8 in 0,01 mm. composed of distinct granules.

Navicula aspera Ehb.

N. directa W. Sm. — Length 0,11 mm. Breadth 0,013 mm. Striæ 6 in 0,01 mm.

N. maxima Greg. var. *Bleischii* Jan (A. Schm. Atl. Pl. L, fig. 22—25) Length 0,13 mm. Striæ 17 in 0,01 mm.

N. maxima Greg. var. *umbilicata* Grun. (A. Schm. Atl. Pl. L, fig. 32—33) Length 0,13 mm. Striæ 12 in 0,01 mm. in the middle, 15 in 0,01 mm. near the ends.

N. elongata Grun. (A. Schm. Atl. Pl. L, fig. 27—29).

N. cancellata Donk. — Length 0,037. Striæ 8 in 0,01 mm.

N. Lyra Ehb.

N. Henedyi W. Sm.

N. spectabilis Greg. — In the sample from Bab-el-Mandeb there occur many intermediate varieties of the three last species, so that no limit between them can be established.

N. circumsecta Grun. (A. Schm. Atl. Pl. XIII, fig. 27).

N. abrupta Greg. (A. Schm. Atl. Pl. III, fig. 1—2).

N. forcipata Grev. (A. Schm. Nord. See Diat. Pl. I, fig. 45).

N. splendida var. *diplosticta* Grun. (A. Schm. Atl. Pl. XIII, fig. 28).

N. Apis Donk. (A. Schm. Atl. Pl. XIII, fig. 21).

N. Weissflogii A. Schm. (Atl. Pl. XII, fig. 27).

N. Gründleri A. Schm. (Atl. Pl. XII, fig. 35—36).

N. dalmatica Grun. (A. Schm. Atl. Pl. VIII, fig. 58).

N. clavata var. *elliptica* A. Schm. Atl. Pl. III, fig. 13.

N. circumsecta Grun. (A. Schm. Atl. Pl. III, fig. 27—28).

N. transfuga Grun. Mpt. — Oval, with somewhat protracted ends. Valve with a depression on each side of the median line, covered with puncta, arranged in somewhat radiant lines, 10 in 0,01 mm., reaching the median line, except around the central nodule, where these are some wedge-shaped areas. Length 0,07 mm. Breadth 0,038 mm. — Pl. 35, fig. 15. — This species has been found by Mr. Grunow in gatherings from the Seyschells.

N. prætexta Ehb. (A. Schm. Atl. Pl. III, fig. 30—34).

N. brasiliensis Grun. (A. Schm. Atl. Pl. VI, fig. 25).

N. Baileyana Grun. (A. Schm. Atl. Pl. VI, fig. 26—27).

N. lacrimans A. Schm. (Atl. Pl. XII, fig. 59—61).

N. Smithii Bréb. (A. Schm. Atl. Pl. VII, fig. 18—19).

N. nitescens Greg. (A. Schm. Atl. Pl. VII, fig. 38—39).

N. nummularia Grev. (A. Schm. Atl. Pl. LXX, fig. 38—40).

N. Campylodiscus Grun. (A. Schm. Atl. Pl. LXX, fig. 64).

N. Eudoxia A. Schm. (Atl. Pl. LXX, fig. 71).

N. serrulata A. Schm. (Atl. Pl. VII, fig. 42—43).

N. Græffii Grun. (A. Schm. Atl. Pl. VII, fig. 5—6).

N. Musca Greg. (A. Schm. Nord Sea Diat. Pl. I, fig. 15).

Alloioneis antillarum Cl. & Grun. (Bih. t. Kongl. Sv. Vet. Ak. Handl. T. V. No 8, pag. 8, Pl. II, fig. 11).

Pleurosigma formosum W. Sm.

P. australe Grun. (Novara. pag. 21, Pl. I, fig. 18).

P. elongatum var. *fallax* Grun. (Arct. Diat. pag. 50, Pl. III, fig. 36). Transverse striæ 22, oblique 20 in 0,01 mm.

P. strigosum W. Sm. var. *convexum* Grun. (Arct. Diat. pag. 50). Transv. striæ 20 oblique 18 in 0,01 mm.

Amphiprora (*Plogiotraxis*) *elegans* W. Sm. (Van Heurck Syn. Pl. XXII, fig. 1—2).

A. Lepidoptera Greg.

Amphiprora rimosa O'Meara (M. J. XI, pag. 22, Pl. III, fig. 1). This curious form, found by O'Meara in gatherings from Seychells, can scarcely belong to *Amphiprora* or to any known genus of diatoms.

Achnanthes danica (Flögel) Grun. (Arct. Diat. pag. 21, *Stauroneis cornuta* Leuduger-Fortm. Ceyl. Pl. III, fig. 36).

Cocconeis? (*Achnanthes?*) *producta* Grun.

Plagiogramma tessellatum Grev. (M. Journ. VII, pag. 208, Pl. X, fig. 7).

P. nankooense Grun. (*P. constrictum* v. *nankooensis* Grun. Nov. pag. 95, Pl. I A., fig. 8. *P. ceylanense* Leuduger-Fortm. Ceyl. pag. 52, Pl. V, fig. 59). This species cannot be a variety of *P. constrictum* Grev., which has transverse costæ at the ends. It occurs fossil in Nankoori and Monterey deposits, living near Madagascar. Rows of puncta 7 in 0,01 mm. In a sample from Port Jackson I have seen a small variety, only 0,035 mm. in length and with 12 rows of puncta in 0,01 mm., var. *minuta* Cl.

Raphoneis? *fluminensis* Grun. (Van Heurck Syn. Pl. XXXVI, fig. 34).

Nitzschia marina Grun. (Arct. Diat. p. 70).

N. Gründleri Grun. var. — Frustle slightly constricted in the middle. Length 0,11. Striæ, composed of elongate puncta, 13 in 0,01 mm. Carinal puncta elongate, 3 in 0,01 mm.

N. distans Greg. var. *quarnerensis* Grun. (Verh. 1862, pag. 580, Pl. XVIII, fig. 6. Arct. Diat. pag. 87).

N. socialis Greg. var. *seychellensis* Grun. (Arct. Diat. pag. 85). Length 0,24 mm. Breadth 0,008 mm. Carinal puncta 7, striæ 16 in 0,01 mm.

N. fluminensis Grun. (Verh. 1862, pag. 37, Pl. XVIII, fig. 35. Arct. Diat. pag. 86).

N. Sigma var. *valida* Cl. & Grun. (Van Heurck Syn. Pl. LXV, fig. 5), Puncta 4, str. 21 in 0,01 mm.

N. Sigma var. *subrecta* Grun. (Casp. Sea Alg. pag. 22). Carinal puncta 8, striæ 30 in 0,01 mm.

N. Sigma var. *Habirshawii* Febiger (Cl. & Möll. Diat. No 223) Puncta 6, striæ 28 in 0,01 mm.

N. insignis Greg. var. *genuina* Grun. (Arct. Diat. pag. 84). Length 0,17 mm. Breadth 0,011 mm. Striæ 10, carinal puncta 6 in 0,01 mm.

N. campechiana Grun. (M. J. III, 1880, Pl. XIII, fig. 16). Length 0,065 mm. Breadth 0,023 at the constriction 0,019 mm. Carinal puncta 3, striæ 24 in 0,01 mm.

N. marginulata Grun. (Arct. Diat. pag. 72, Pl. IV, fig. 93). Length 0,093 mm. Breadth 0,013 mm. Carinal puncta 12—14, striæ 25 in 0,01 mm.

N. Jelineckii Grun. (Arct. Diat. pag. 74).

N. panduriformis Greg. var.

N. diluvialis Cl. conf. pag. 150.

Pseudoeunotia Doliolus (Wallich) Grun. (Van Heurck Syn. Pl. XXXV, fig. 22).

Climacosphenia elongata -Bail.

Surirella fluminensis Grun. (A. Schm. Atl. Pl. V, fig. 6).

S. Lorenziana Grun. (A. Schm. Atl. Pl. V, fig. 5).

S. patens A. Schm. (Atl. Pl. VI, fig. 16—17).

S. mexicana A. Schm. (Atl. Pl. VI, fig. 10—12).

S. lepida A. Schm. (Atl. Pl. IV, fig. 3—5).

S. cuneata A. Schm. (Atl. Pl. IV, fig. 1).

S. orbicularis Cl. N. Sp. — Valve orbicular, 0,075 mm. in diameter. Canaliculi distant 1—1½ in 0,01 mm., a little more than half of the radius in length, encircling a depressed central area, which is almost smooth. Margin striate with 18 striæ in 0,01 mm. — This beautiful species should perhaps be more correctly arranged in the genus *Campylodiscus*, where it seems to come near to *C. Helianthus*, but I think nevertheless it is most nearly related to *Surirella fastuosa*. — Pl. 38, fig. 79, ⁵⁰⁰/₁.

Campylodiscus undulatus Grev. (A. Schm. Atl. Pl. XVIII, fig. 11).

C. decorus Bréb. (A. Schm. Atl. Pl. XIV, fig. 4—5).

C. Ralfsii W. Sm. (A. Schm. Atl. Pl. XIV, fig. 1).

C. crebrecostatus Grev. (A. Schm. Atl. Pl. XV, fig. 16—17).

C. subangularis Grun. (A. Schm. Atl. Pl. XVIII, fig. 5—6).

C. densecostatus Cl. — Diam. 0,084 mm. Canaliculi numerous, 6 in 0,01 mm., reaching to the median raphe and interrupted by a circular furrow, ¼ of the radius distant from the margin. — Pl. 38, fig. 76.

C. limbatus var. *minuta* Cl. — Diam. 0,027—0,035 mm. Canaliculi about 9 in 0,01 mm. — Pl. 38, fig. 77.

Rhizosolenia ornithoglossa Ehb.? — Some fragments, probably belonging to this species.

Chaetoceros coarctatus Laud.? — Some fragments, which seem to belong to this species.

Biddulphia pulchella Gray.

B. Tuomeyi Roper (T. M. S. VII, Pl. I, fig. 1—2).

B. dubia (Btw.) Cl. (Tricerat. dubium Btw. T. bicornis Cl.).

Triceratium Favus Ehb.

T. cinnamomeum Grev. (T. M. S. III, Pl. IX, fig. 12).

T. Pentacrinus Wallich.

T. punctatum Btw. (A. Schm. Atl. Pl. LXXVI, fig. 19—20).

T. sculptum Shadb. A. Schm. Atl. l. c. fig. 9—10).

Hemidiscus cuneiformis Wallich.

Palmeria Hardmaniana Grev.

Coscinodiscus africanus Jan. (A. Schm. Atl. Pl. LIX, fig. 24—25).

C. subtilis Ehb. (A. Schm. Atl. LVII, fig. 13—14).

C. denarius A. Schm. (Atl. Pl. LVII, fig. 20—21).

C. radiatus Ehb. (A. Schm. Atl. Pl. LX, fig. 57).

C. excentricus Ehb.

C. nodulifer A. Schm. (Atl. Pl. LIX, fig. 21).

C. concavus Greg. (Diat. of Cl. Pl. II, fig. 47).

C. lineatus Ehb. (A. Schm. Atl. Pl. LIX, fig. 26).

Podosira maxima (Kg.) Grun. (Arct. Diat. pag. 118).

Melosira (Paralia) marina Ehb.

Actinopterychus undulatus Ehb.

Asteromphalus Arachne Bréb. (A. Schm. Atl. Pl. XXXVIII, fig. 3—4).

A. elegans Ralfs (A. Schm. Atl. XXXVIII, fig. 1—2).

Explication of the Plates.

Pl. 35.

1. *Amphora Labuensis* Cl. Labuan ¹⁰⁰⁰_I.
2. *Achnanthes pennata* Grev. Ceylon ¹⁰⁰⁰_I.
3. *A. grönlandica* Cl. Bessel's Bay ¹⁰⁰⁰_I.
4. *Cocconeis arctica* Cl. Bessel's Bay ¹⁰⁰⁰_I.
5. *Mastogloia* (*acutiuscula* var.?) *Labuensis* Cl. Labuan ¹⁰⁰⁰_I.
6. *M. Kjellmanii* Cl. Labuan ¹⁰⁰⁰_I.
7. *M.* (*baltica* var?) *Citrus* Cl. Labuan ¹⁰⁰⁰_I.
8. *M. acuta* Grun. var.? Labuan ¹⁰⁰⁰_I.
9. *M. rhombica* Cl. Labuan ¹⁰⁰⁰_I.
10. *Stauroneis pellucida* Cl. Cape Wankarema ¹⁰⁰⁰_I.
11. *Amphiprora kryophila* Cl. Cape Wankarema ¹⁰⁰⁰_I a F. V., b. S. V.
12. *A. glacialis* Cl. Cape Wankarema ¹⁰⁰⁰_I.
13. *Pleurosigma glaciale* Cl. Cape Wankarema a ⁴⁷⁵_I, b structare ²⁰⁰⁰_I.
14. *P. Clevei* Grun. var. *siberica* Grun. Cape Wankarema ⁹⁰⁰_I.
15. *Navicula transfuga* Grun. Bab-el-Mandeb ¹⁰⁰⁰_I.
16. *N. nicobarica* Grun. Ceylon ¹⁰⁰⁰_I.
17. *N. syblyrata* Grun. var. Labuan ¹⁰⁰⁰_I.
18. *N. cruciformis* var. *brevior* Cl. Cape Deschnew (East Cape) ¹⁰⁰⁰_I.
19. *N. megastauros* Cl. Cape Deschnew (East Cape) ¹⁰⁰⁰_I.

Pl. 36.

20. *Navicula decurrens* (Ehb.) Grun. Cape Deschnew (East Cape) ¹⁰⁰⁰_I.
21. *N. Pinnularia* Cl. var. *interrupta* Cl. Cape Wankarema ¹⁰⁰⁰_I.
22. *N. Leudugeri* Cl. Ceylon ¹⁰⁰⁰_I.
23. *N. (Rhoikoneis) superba* Cl. Cape Wankarema ¹⁰⁰⁰_I. Both valves of the same frustle.
24. *N. (Rhoikoneis) superba* var. *elliptica* Cl. Cape Wankarema ¹⁰⁰⁰_I.
25. *N. (Rhoikoneis) obtusa* Cl. Cape Wankarema ¹⁰⁰⁰_I.
26. *N. incudiformis* Grun. Cape Wankarema ¹⁰⁰⁰_I.
27. *N. asymmetrica* Cl. Cape Wankarema ¹⁰⁰⁰_I.
28. *N. erosa* Cl. Cape Wankarema ¹⁰⁰⁰_I.

29. *N. trigonocephala* Cl. Cape Wankarema ¹⁰⁰⁰_I.
30. *N. incudiformis* Grun. var. Cape Wankarema ¹⁰⁰⁰_I.
31. *N. transitans* Cl. Cape Wankarema ¹⁰⁰⁰_I.
32. *N. (transitans* Cl. var.) *derasa* Grun. Cape Wankarema ¹⁰⁰⁰_I.
33. *N. transitans* Cl. type. Cape Wankarema ¹⁰⁰⁰_I.
34. *N. imperfecta* Cl. Cape Wankarema ¹⁰⁰⁰_I.
35. *N. retusa* Bréb. Cape Wankarema ¹⁰⁰⁰_I.
36. *N. detera* Grun. Cape Wankarema ¹⁰⁰⁰_I.
37. *N. transitans* Cl. forma *minuta*. Cape Deschnew (East Cape) ¹⁰⁰⁰_I.

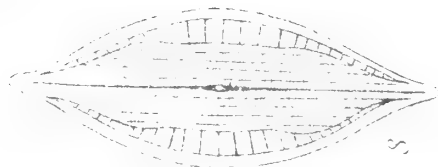
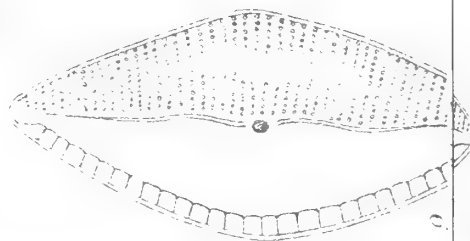
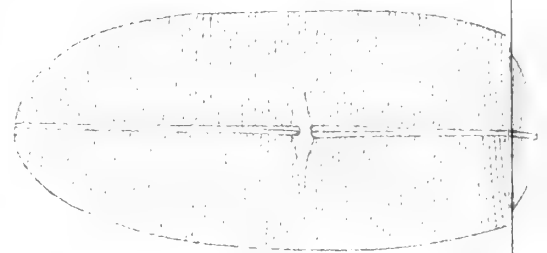
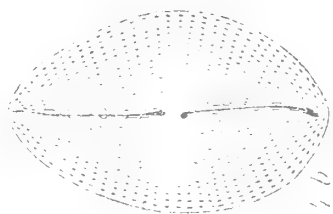
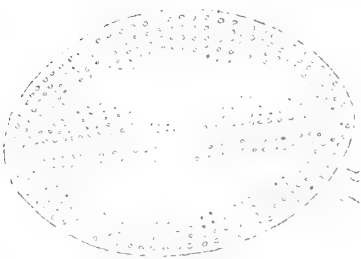
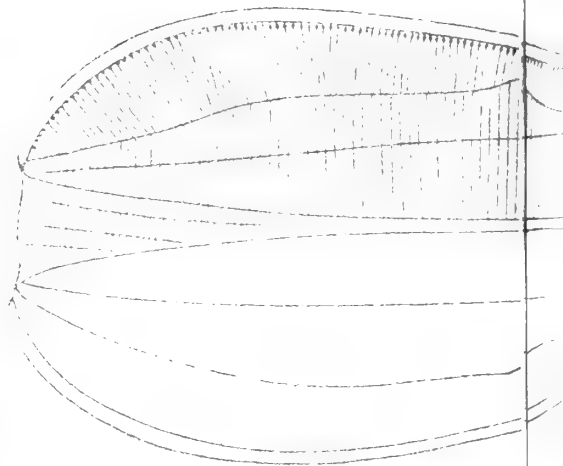
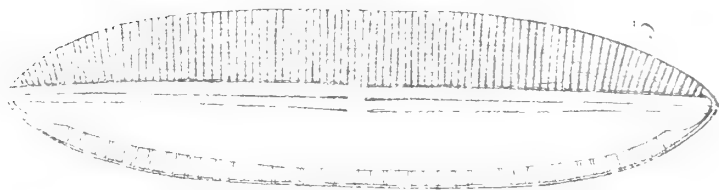
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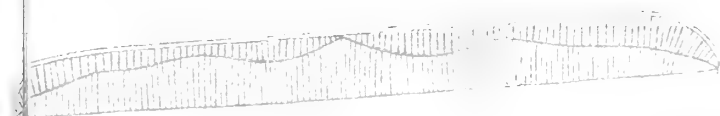
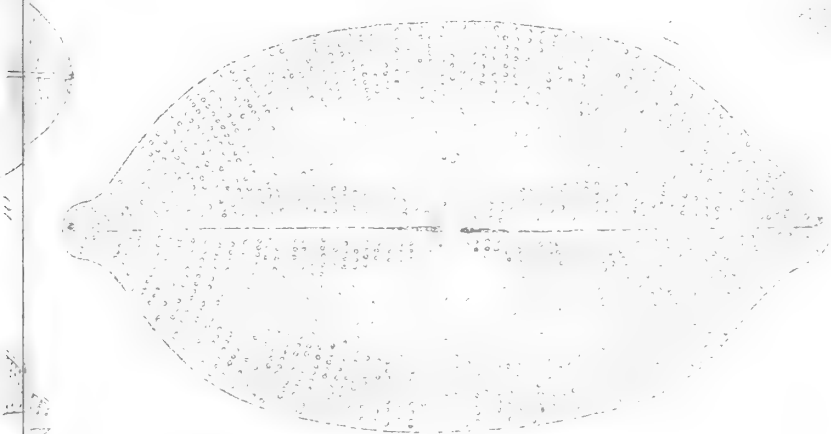
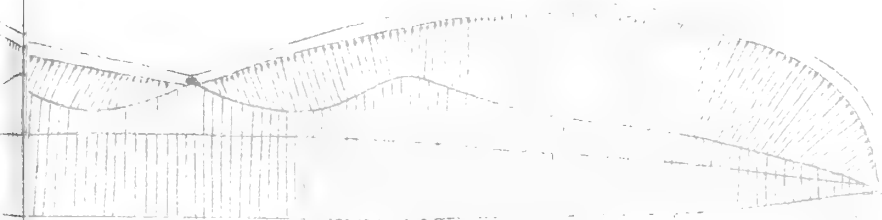
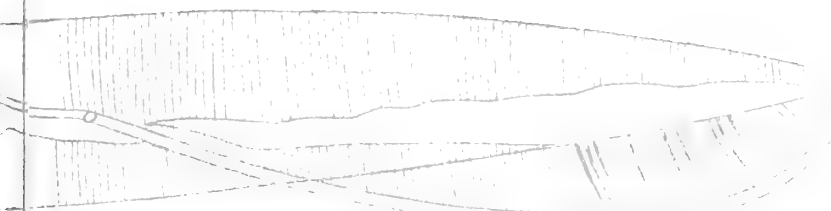
38. *Navicula (Rhoikoneis) Bolleana* var.? *siberica* Grun. Cape Wankarema ¹⁰⁰⁰_I.
39. *N. (Rhoikoneis) Bolleana* var. *asymmetrica* Cl. Cape Wankarema ¹⁰⁰⁰_I.
40. *N. Kariana* Grun. var. *minor*, f. *curta*. Cape Wankarema ¹⁰⁰⁰_I.
41. *N. glacialis* Cl. var. Cape Wankarema ¹⁰⁰⁰_I.
42. *N. gelida* Cl. Cape Wankarema ¹⁰⁰⁰_I.
43. *N. kryophila* Cl. Cape Wankarema ¹⁰⁰⁰_I.
44. *N. kryokonites* Cl. Cape Wankarema ¹⁰⁰⁰_I.
45. *N. kryokonites* Cl. var. *semiperfecta* Cl. Cape Wankarema ¹⁰⁰⁰_I.
46. *N. kryokonites* Cl. var. *subprotracta* Cl. Cape Wankarema ¹⁰⁰⁰_I.
47. *N. (kryokonites* var.?) *Wankaremæ* Cl. Cape Wankarema ¹⁰⁰⁰_I.
48. *N. Tschuktschorum* Cl. Cape Deschnew (East Cape) ¹⁰⁰⁰_I.
49. *N. subimpressa* var. *tenuior* Cl. Cape Deschnew (East Cape) ¹⁰⁰⁰_I.
50. *N. subinflata* Grun. Cape Wankarema ¹⁰⁰⁰_I.
51. *N. Baculus* Cl. Cape Wankarema ¹⁰⁰⁰_I.
52. *Raphoneis amphiceros* Ehb. Labuan ¹⁰⁰⁰_I a. typical b. form intermediate between *Rh. amph.* var. *californica* and var. *cruciata* c. intermediate between var. *cruciata* and *pentagona*.
53. a. b. *Raphoneis quarnerensis* Grun. var.? Labuan ¹⁰⁰⁰_I.
54. *Trachyspenia australis* H. L. Sm. var. *elliptica* Cl. Labuan ¹⁰⁰⁰_I.
55. *Raphoneis?* *bilineata* Cl. & Grun. Labuan ¹⁰⁰⁰_I.
56. *R. maculata* Cl. Labuan ¹⁰⁰⁰_I.
57. *R.?* *marginata* Cl. & Grun. Labuan ¹⁰⁰⁰_I.
58. *Dimerogramma ceylanica* Cl. Ceylon ¹⁰⁰⁰_I.
59. a. b. *Plagiogramma Seychellarum* Grun. Labuan ¹⁰⁰⁰_I.
60. *Sceptroneis intermedia* Cl. Ceylon a ³⁰⁰_I b ¹⁰⁰⁰_I.
61. a. b. *Plagiogramma interruptum* var. *adriatica* Labuan Grun. ¹⁰⁰⁰_I.
62. Pl. (*caribæum* Cl. var.?) *Labuense* Cl. Labuan ¹⁰⁰⁰_I.
63. Pl. *tenuistriatum* Cl. Labuan ¹⁰⁰⁰_I.
64. a. b. c. *Fragilaria (?) Cylindrus* Grun. Cape Wankarema ¹⁰⁰⁰_I.

65. *Nitzschia hybrida* var. *kryokonites* Cl. Cape Wankarema 1000_I .
 66. *N. labuensis* Cl. Labuan 1000_I .
 67. *N. (punctata* var?) *diluviana* Cl. Labuan 1000_I .
 68. *N. Denticula* var. Japan 1000_I .

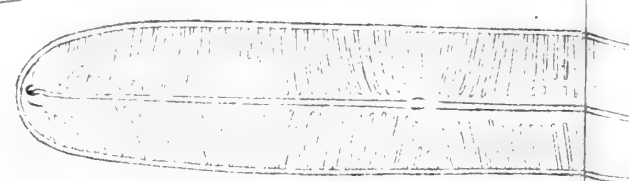
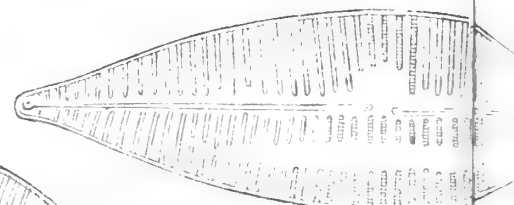
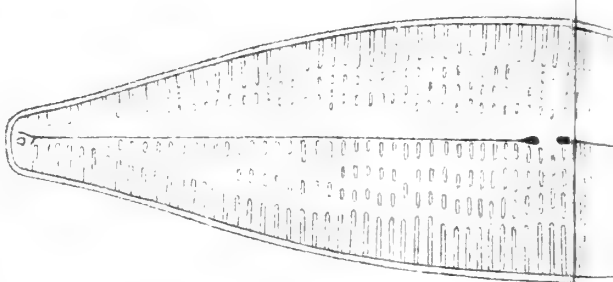
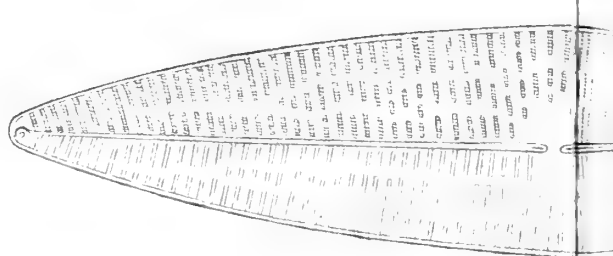
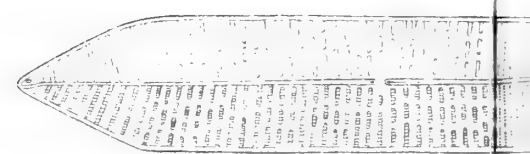
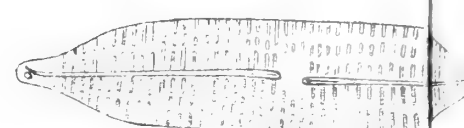
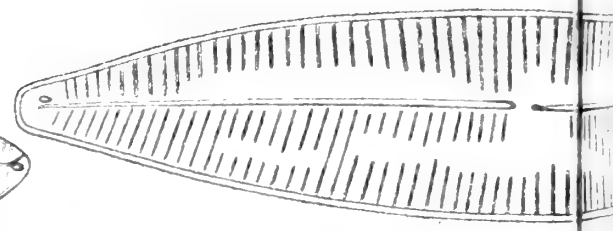
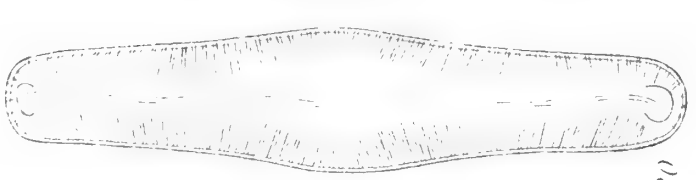
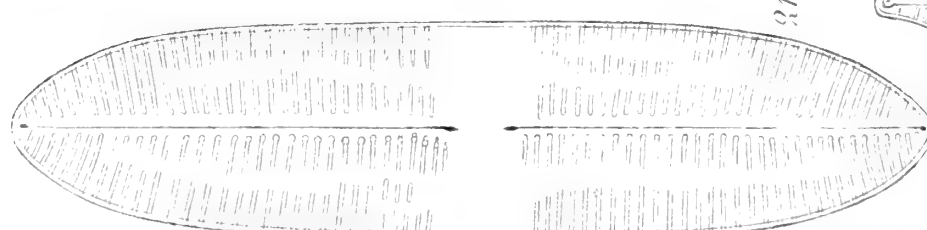
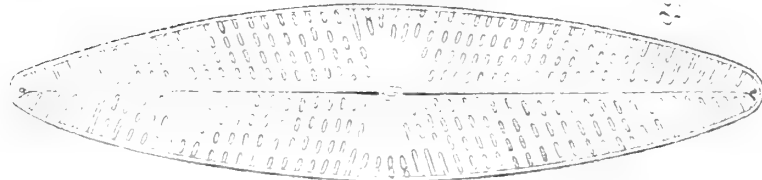
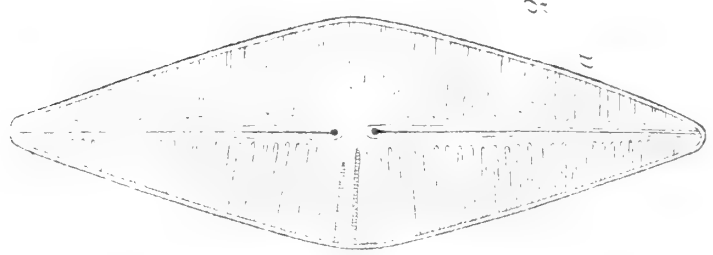
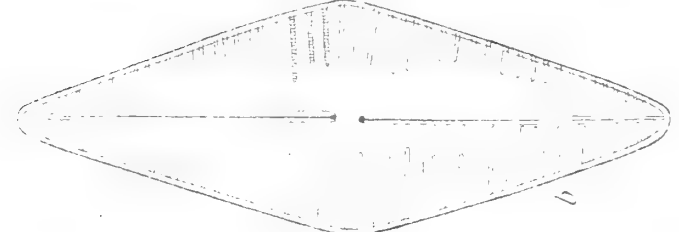
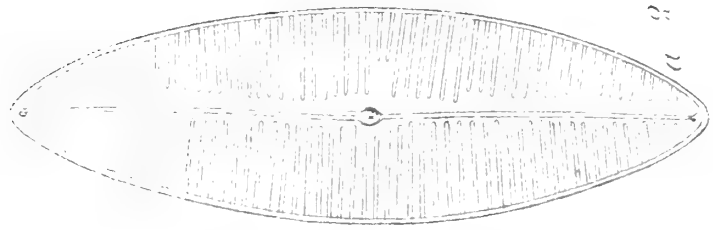
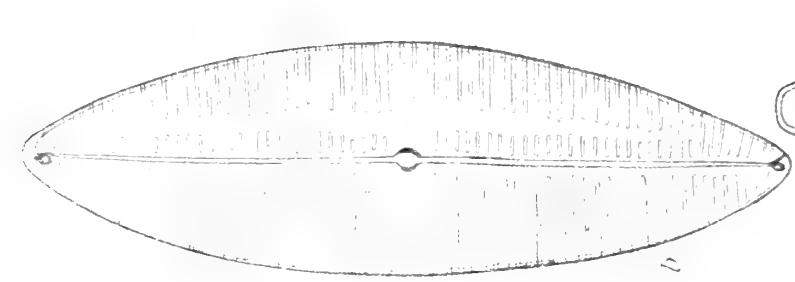
Pl. 38.

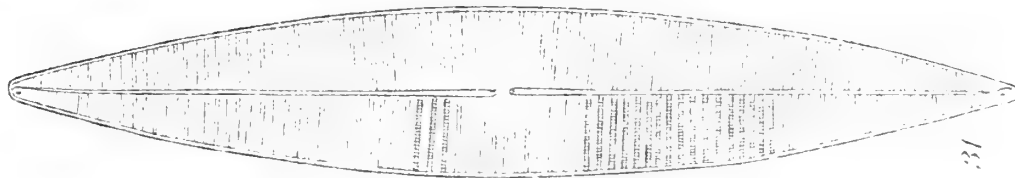
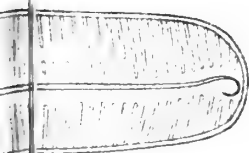
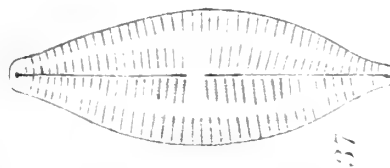
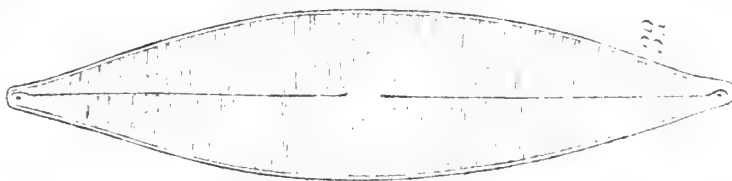
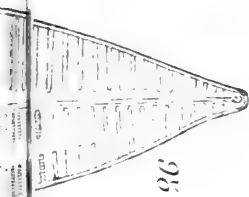
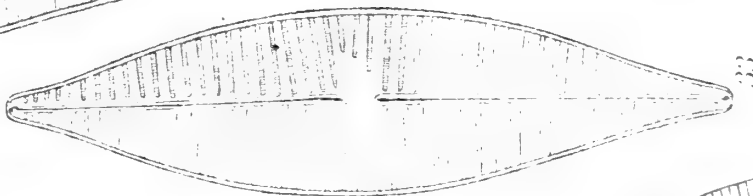
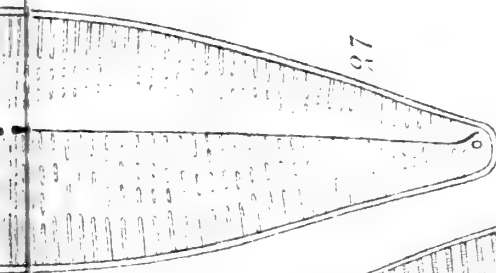
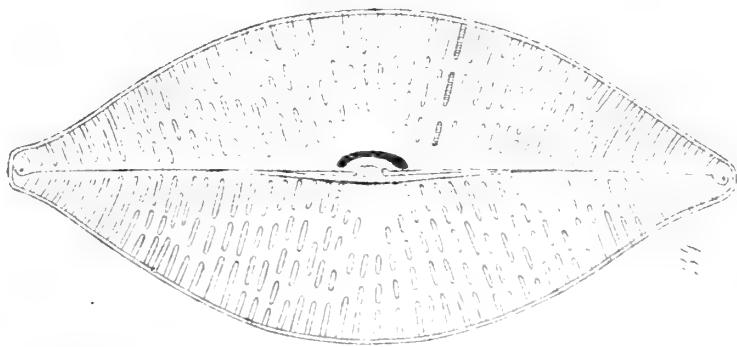
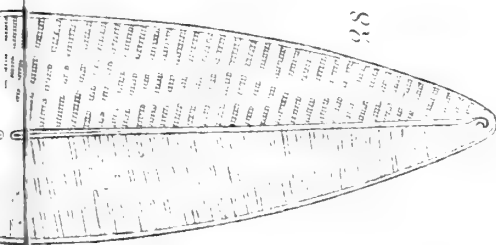
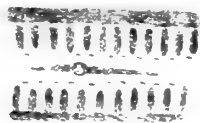
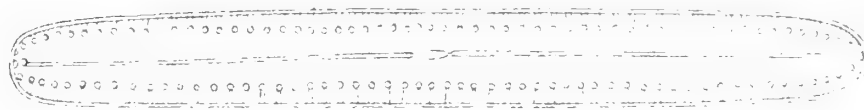
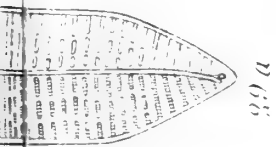
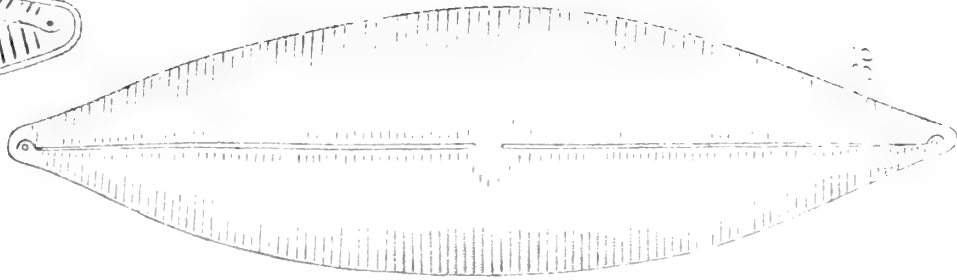
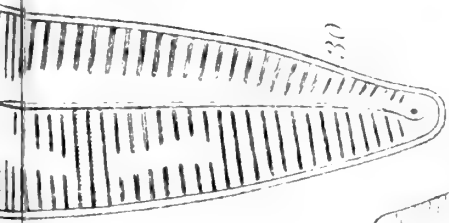
69. *Rhizosolenia hebeta* Bail. Sea of Behring a. b. d. e. f. 300_I c. 1000_I .
 70. *Nitzschia gelida* Cl. & Grun. Cape Wankarema a. 480_I b. c 1000_I .
 71. *N. wankaremæ* Cl. Cape Wankarema 1000_I .
 72. a. b. *N. polaris* Grun. Cape Wankarema 1000_I .
 73. a. b. *N. (Sigma* var?) *scabra* Cl. Cape Wankarema 1000_I .
 74. *N. (obtusa* var.??) *kryophila* Cl. Cape Wankarema 1000_I .
 75. *N. (?) seriata* Cl. Greenland 1000_I .
 76. *Campylodiscus densecostatus* Cl. Bab-el-Mandeb 500_I .
 77. *C. limbatus* var. *minuta* Cl. Bab-el-Mandeb 1000_I .
 78. *C.? cocconeiformis* Grun. Labuan 1000_I .
 79. *Surirella orbicularis* Cl. Bab-el-Mandeb 500_I .
 80. a. b. *Cerataulus labuensis* Cl. Labuan 1000_I .
 81. *Coscinodiscus bathyomphalus* Cl. 1000_I a. Spitsbergen, b. Cape Wankarema.
 82. *Coscinodiscus (Hauchii* Grun var.? *mesoleins*) Cl. Labuan 1000_I .
 83. *Melosira (mediterranea* Grun. var.?) *gelida* Cl. Mushroom Point 1000_I .
 84. *Melosira labuensis* Cl. Labuan 1000_I .

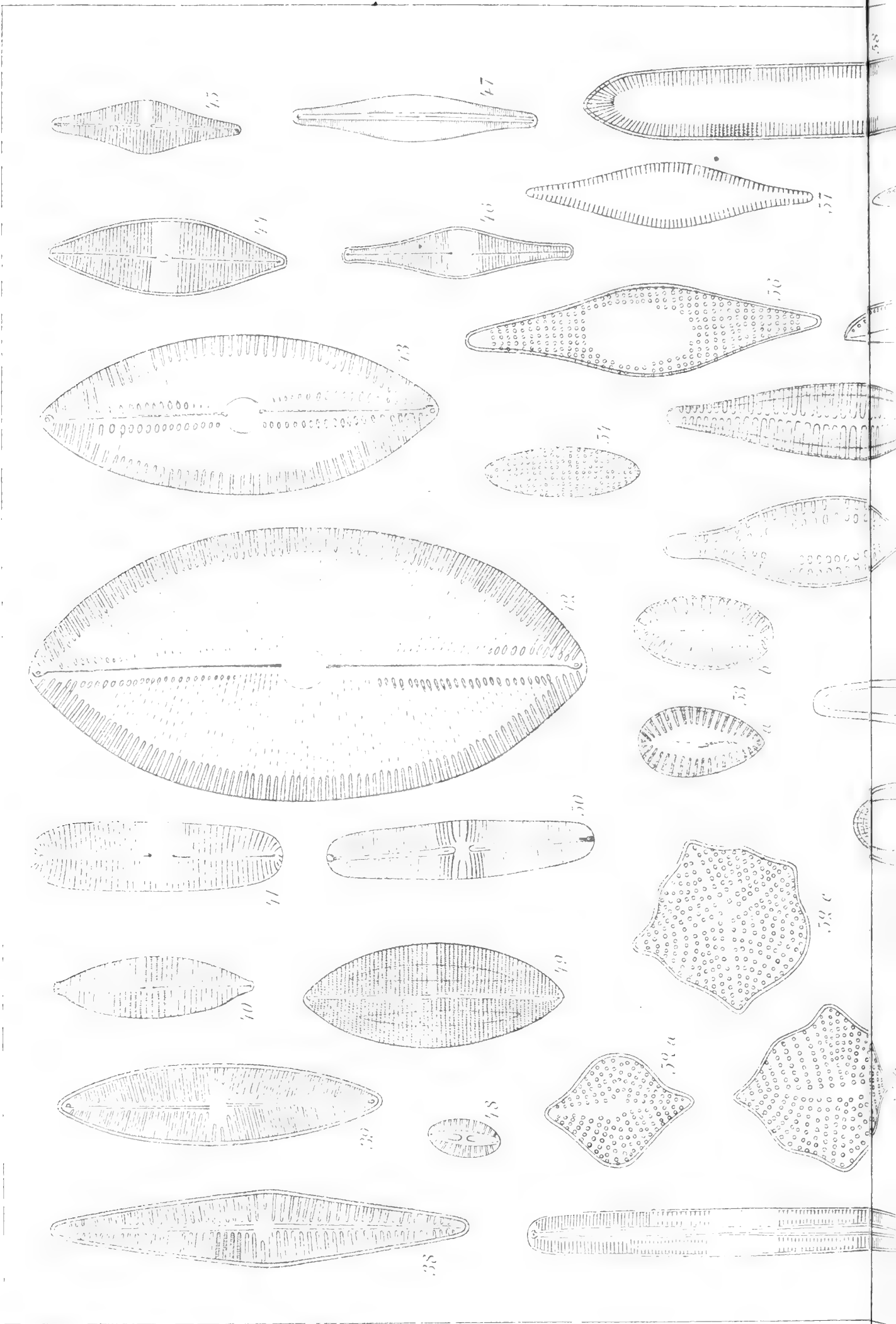


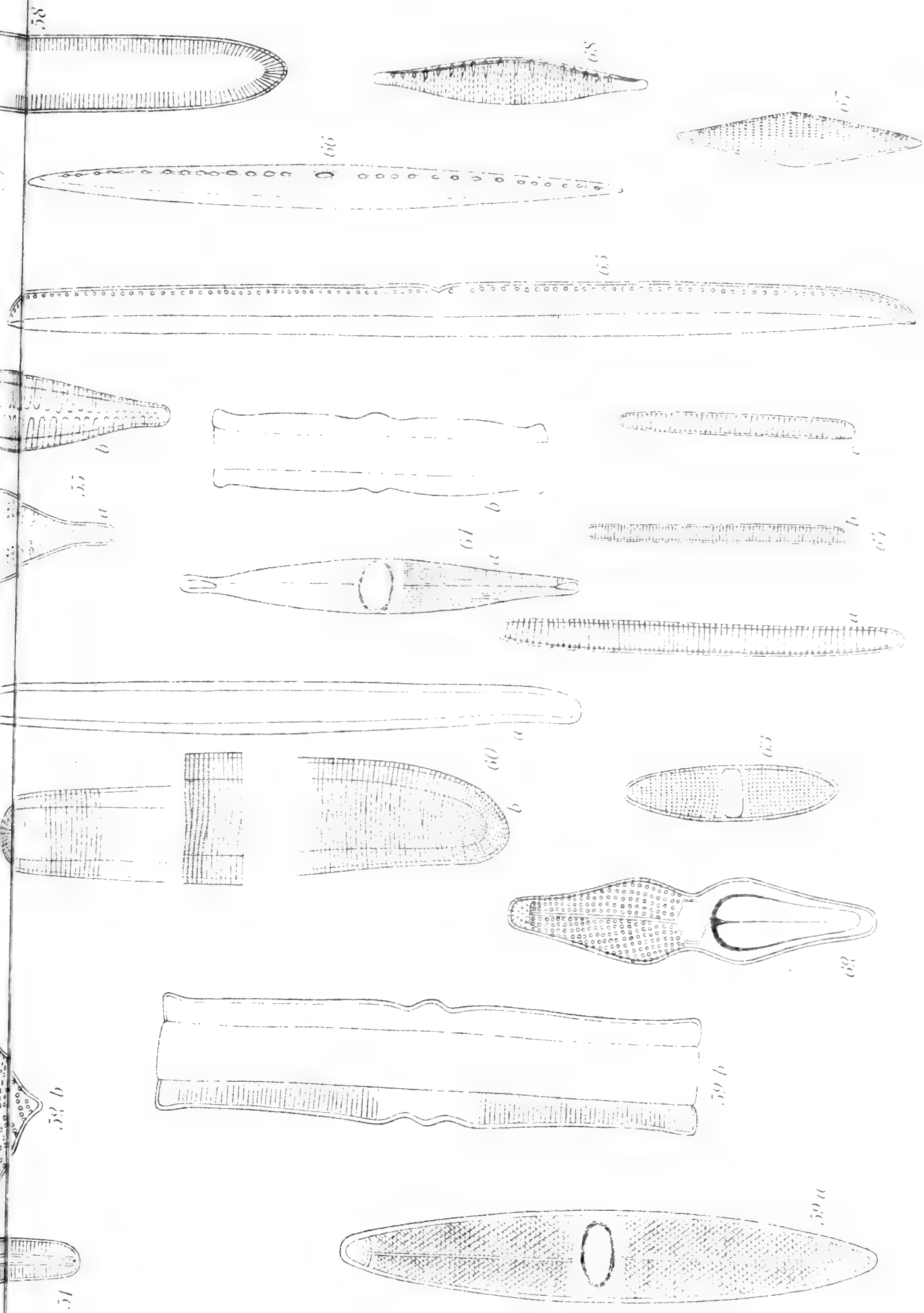


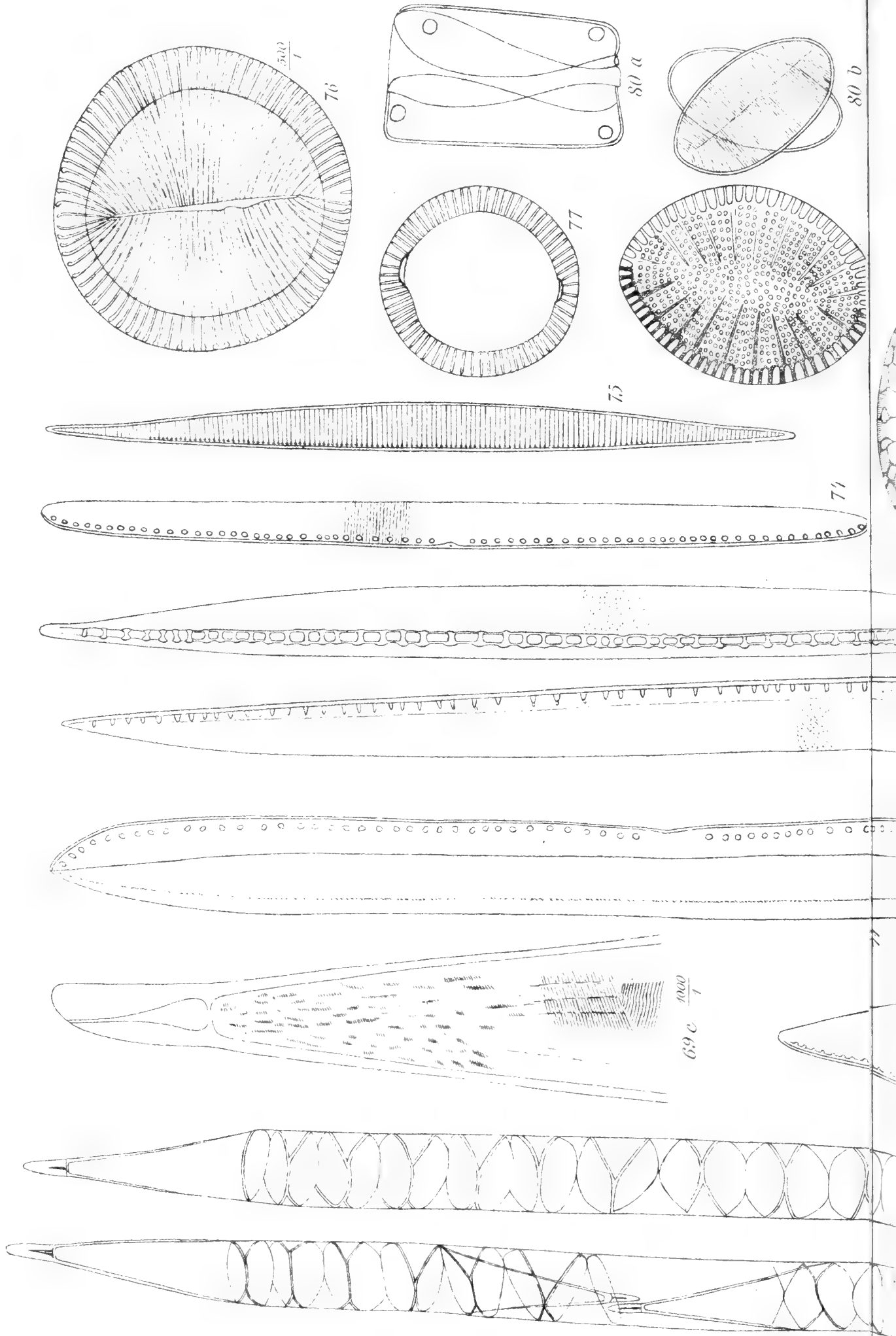
Yves-André Delbecq

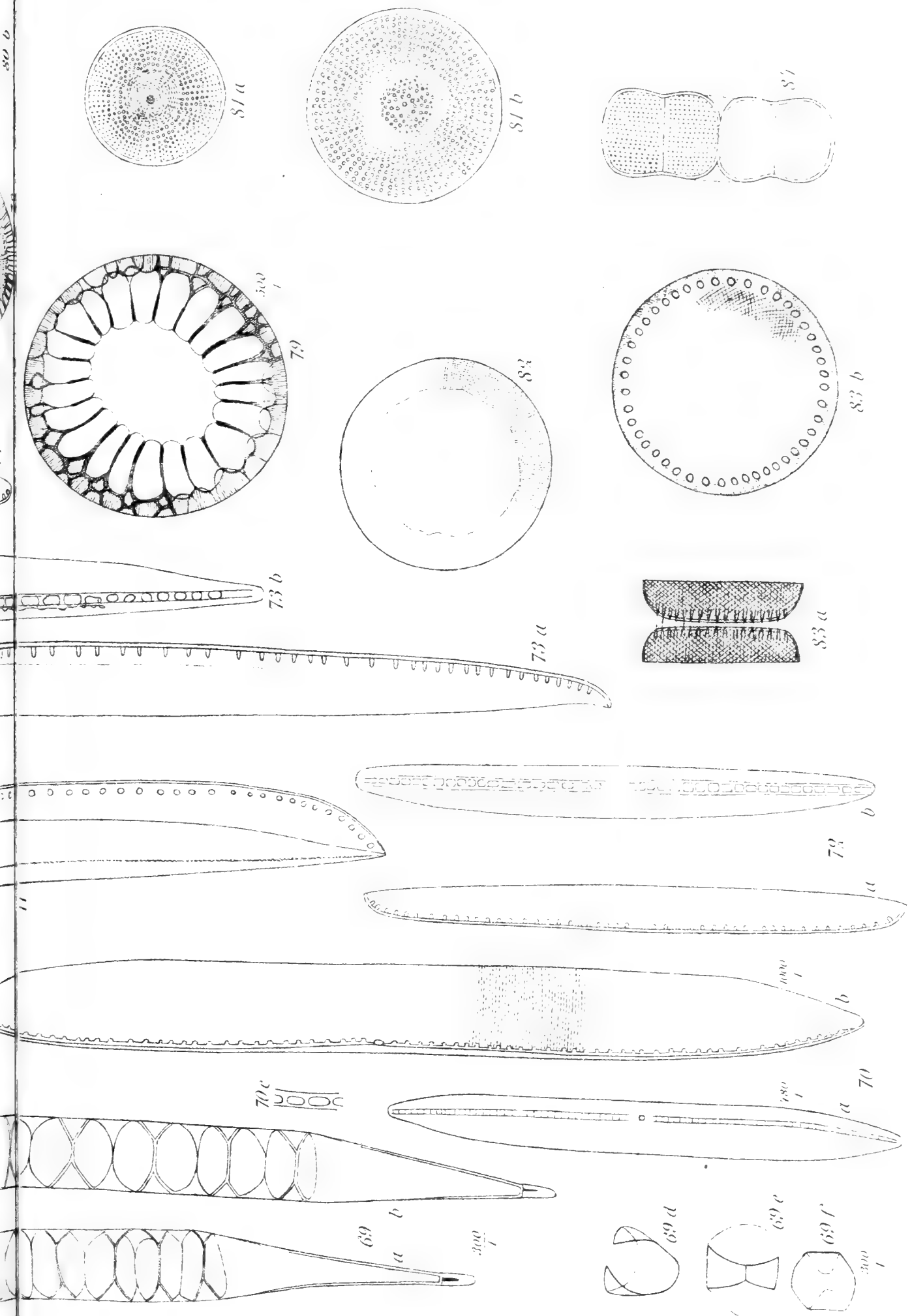


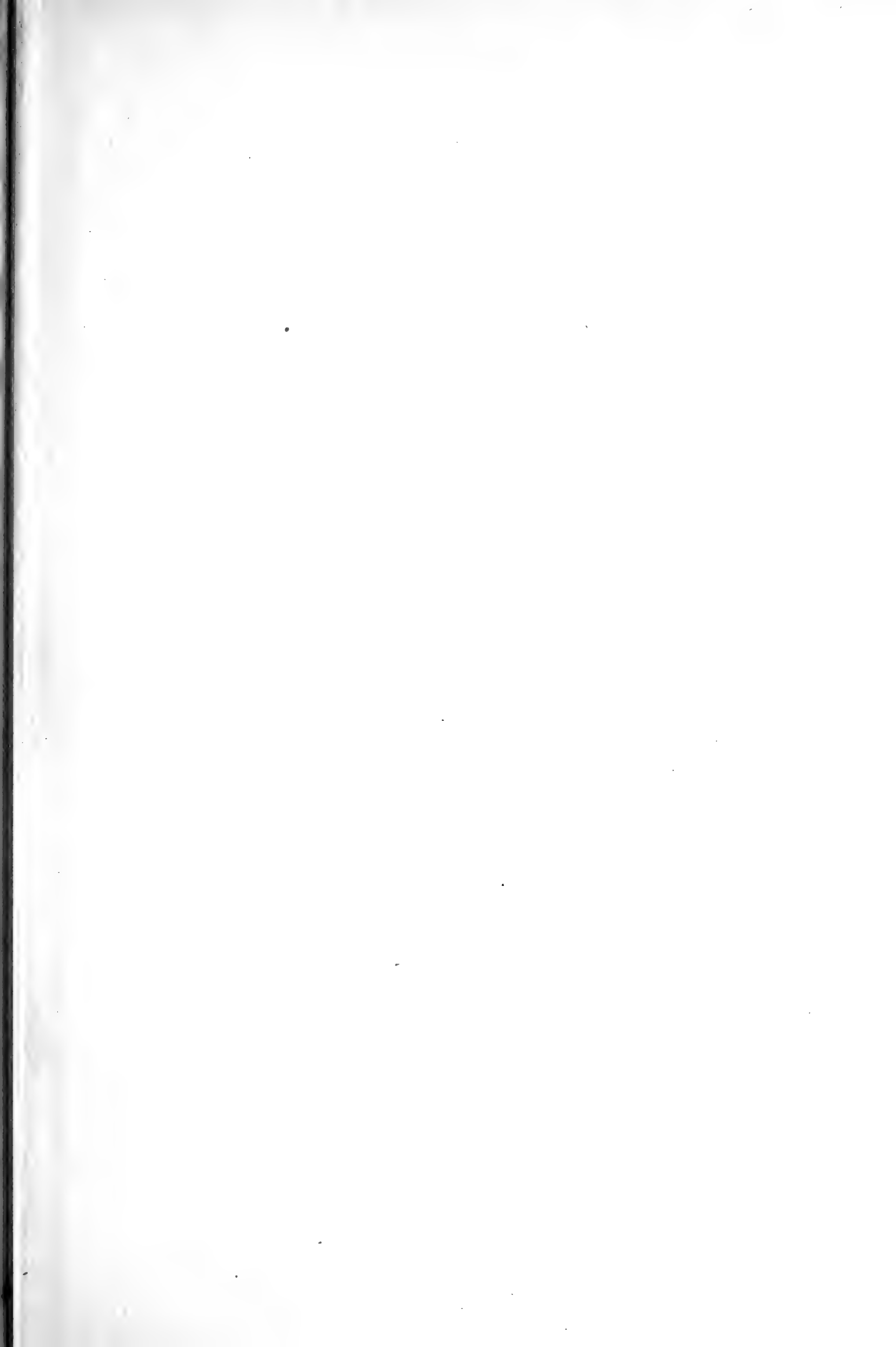


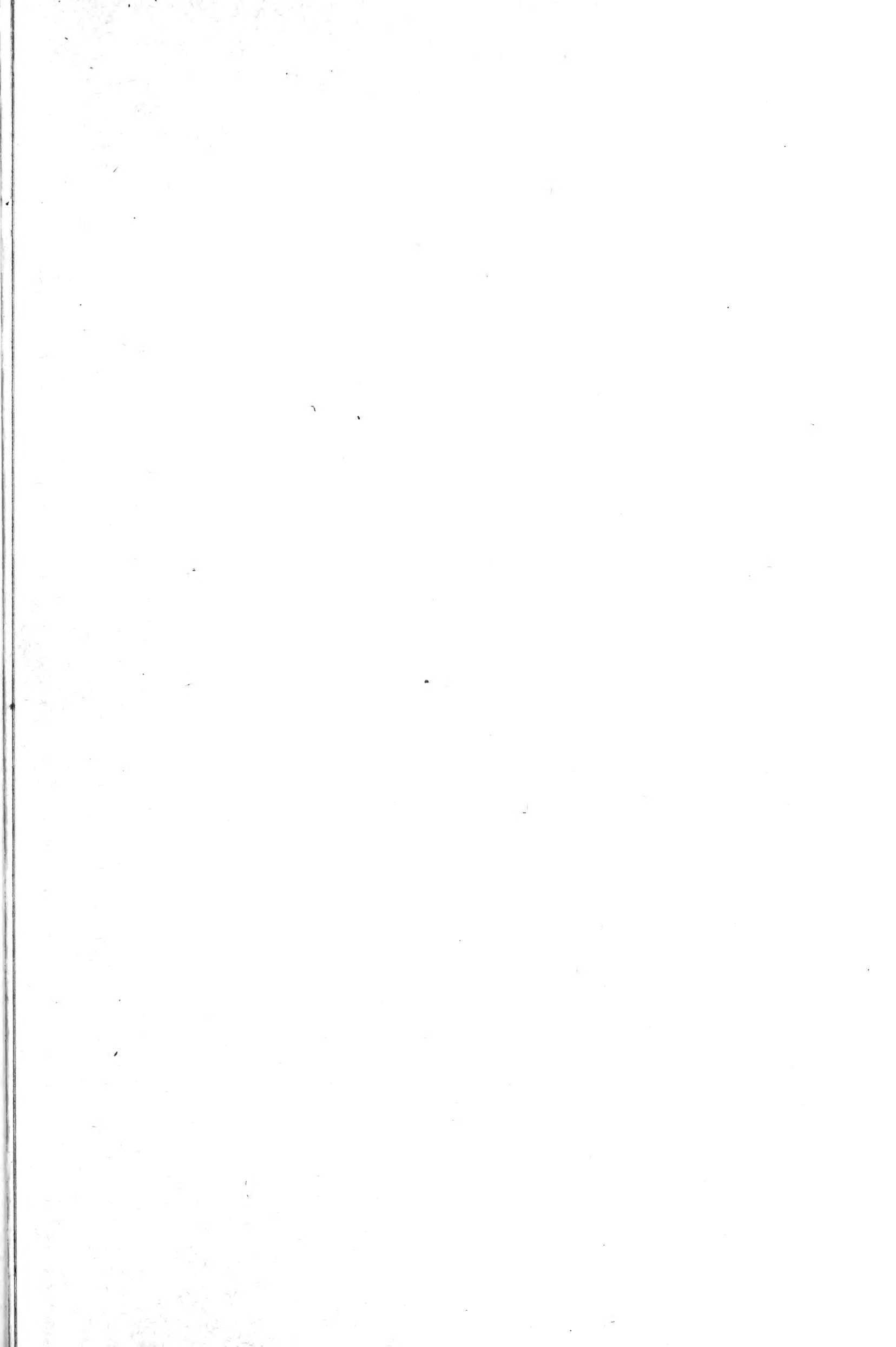












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